Urban Freeway Removal:

Building a Case for the Re-Purposing of I-5 through Downtown Seattle

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ABSTRACT

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The construction of the U.S. interstate system during the 1950s and 1960s was harmful for American urban environments. That ultimately left behind a concrete jungle of elevated and depressed structures that transformed traditional dense walking cities into auto-oriented ones, dedicating vast amounts of space to the movement and storage of cars. Today we struggle with the consequences of these design decisions, felt in growing traffic congestion, harmful environmental conditions, and dysfunctional urban districts. With many urban freeways reaching the end of their design lives urbanists, planners, and officials have started to reevaluate past transportation policy and even discuss eliminating sections of freeways within the urban fabric as a means of saving money, removing barriers and freeing up desirable and scarce urban land for what they deem more pressing uses. The purpose of this thesis is to consider re-purposing of a section of I-5's corridor through downtown Seattle, and the research seeks to understand why it could be a viable option for improving the quality of life in the city, avoiding a budget-crippling rebuild, and help facilitate further investment in mass transit to provide more mobility options. Embarking on a project like this would be challenging for Seattle due to jurisdictional issues, varying priorities, high traffic volumes, lack of available case studies and regional economic concerns, however, with I-5 occupying valuable urban land and with traffic congestion worsening, and understanding that expanding the highway is neither fruitful in terms of congestion relief or feasible due to a lack of space and budget constraints, it is time to examine bold interventions, such as freeway removal, that seek to remove cars from the road, that can meet many planning objectives like housing development and multi-modal transit while also confronting past planning mistakes and establishing a new paradigm for urban living.

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I would like to thank my parents for their unfailing patience, trust, and support. Thank you for giving me the space to challenge myself, it has profoundly shaped this experience.

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Chapter 1 INTRODUCTION

1.1 Urban Freeway Removal

Nearly 45 years ago the City of Portland, Oregon razed the Harbor Drive Freeway providing the first American example of freeway removal. The Harbor Freeway was constructed in 1942 alongside the Willamette River to connect an industrial neighborhood, a lake and areas south of the downtown. However, by 1968, residents wanted more open space along the waterfront where the freeway stood, so a study was initiated to determine if the freeway could be removed. Driven by community activists and public support, the freeway was closed and demolished in 1974 and construction of a 37-acre waterfront park began, laying the foundation for Portland's famously successful urban revitalization.[1]

Figure 1 Portland's Waterfront along the Willamette River

Source: https://www.newscastic.com/news/bring-out-your-inner-runner-with-these-portland-running-routes-2540993/

Across the United States there are currently over 12,000 miles of urban interstate freeways taking up 100,000 acres of real estate, and affecting 500 American cities.[2] With cities presently experiencing a renaissance marked by population growth, rising property values, declining crime levels, and

[1] "6 Case Studies in Urban Freeway Removal," City of Seattle, accessed February 16, 2018 http://www.cityofseattle.net/transportation/docs/ump/06%20SEATTLE%20Case%20studies%20in%20urban%20freeway%20removal.pdf.

[2] Langdon, Philip. "2004: A year of ample progress for New Urbanism," *New Urban News* 9, no. 8 (December 2004): 4

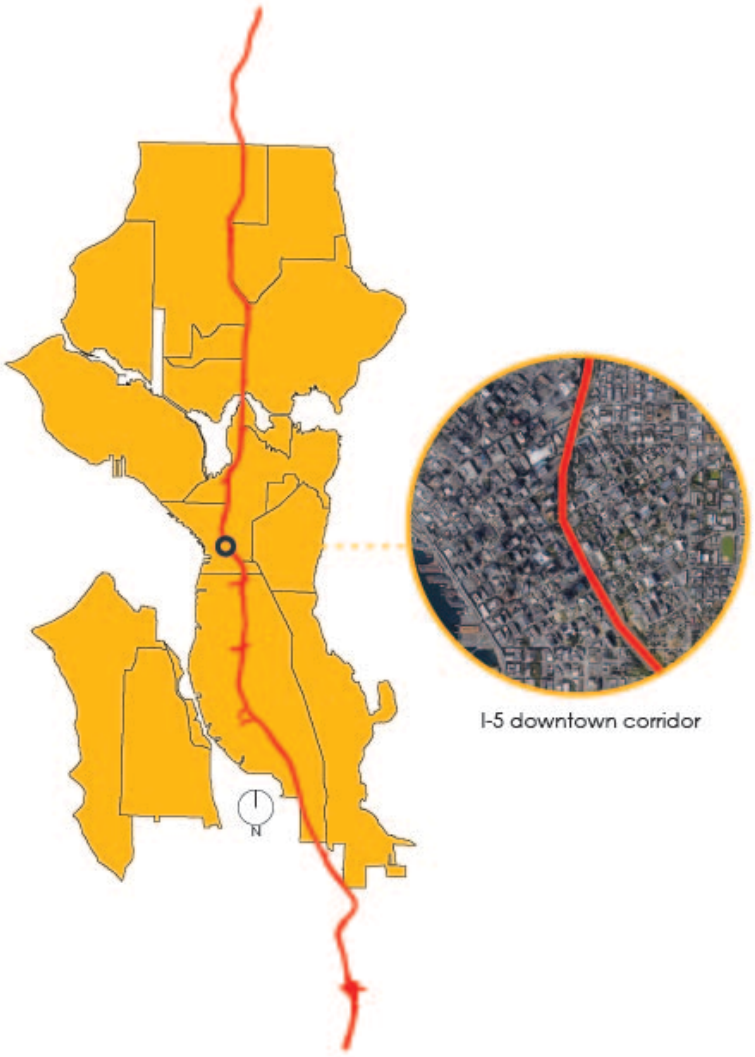

Figure 2 I-5 corridor through Seattle: Map by author

improved quality of life, urban freeways and their futures have come into sharper focus because of their expensive maintenance, the pollution they generate, and the space they occupy within the urban environment. Quality of life concerns, to which urban freeways remain a constant detriment, make up a large part of this resurgence and conversation.[3] Many cities are now re-evaluating past highway policy that pushed freeways through central cities causing damage to housing, businesses, and neighborhoods.[4]

In Seattle, Washington Interstate 5 (I-5) running north-south through the city center, effectively divides the city. Its presence has separated whole neighborhoods, creating a physical barrier for those who seek to travel between them. Pedestrians and cyclists have trouble navigating the limited routes over or under the freeway, often having to interact with the vehicular traffic attempting the same, creating an unpleasant and more importantly, unsafe environment. The

[3] Napolitan, Francesca, and P. Christopher Zegras. "Shifting Urban Priorities?" Transportation Research Record 2046, no. 1 (2008): 68-75.
[4] Mohl, Raymond A. 2012. "The Expressway Teardown Movement in American Cities: Rethinking Postwar Highway Policy in the Post-Interstate Era." Journal of Planning History 11 (1): 89–103

corridor through downtown is routinely congested for many hours throughout the day and the idling traffic emits pollution into the air of a downtown full of people living and working. While I-5 acts as an important regional connection for the west coast, its Seattle corridor fails to move traffic efficiently by inducing demand, a concept that suggests increasing travel capacity actually generates more traffic, and occupying crucial urban land that could be better used for much needed multi-modal roads, additional affordable housing, or open space. Without I-5 running through the city center, Seattle's urban fabric would again flow from Elliott Bay, up to Capitol Hill, and down to the shores of Lake Washington without major interruption, opening up the possibility for traffic to redistribute itself more evenly, urban land to be used in more versatile ways, and people to feel more comfortable walking or biking throughout the city. Removing a portion of I-5 and replacing it with an at-grade boulevard would allow for a multi-modal corridor that would facilitate the movement of all modes of transit; cars, buses, trucks, bikes and even pedestrians. This would also help establish better east-west movement in the city, allowing for more paths to become available, eliminating the need to find the limited ways over or under the freeway. Replacing freeways with at-grade boulevards is a strategy used in freeway removal examples such as San Francisco and New York later examined in this thesis.

With many cities facing similar issues, urbanists, planners, and even some elected officials across the U.S., have started to contemplate eliminating sections of freeways within the urban fabric as a means of removing barriers and freeing up desirable land for other, more pressing, uses.[5] Removing portions of freeways demonstrates a prioritization of the well-being of neighborhoods over vehicular mobility by promoting economic redevelopment, creating attractive and livable environments, and reconnecting city grids that help reintegrate communities alienated

[5] Kraft-Klehm, Jessica. "21st Century Futurama: Contemplating Removal of Urban Freeways in the World of Tomorrow." Washington University Journal of Law and Policy 49, no. 1 (2015): 205.

and disadvantaged by the freeway's initial construction. By eliminating the physical barriers freeways create, local residents can have greater mobility and access to economic opportunities in city centers. Additionally, commuters can also obtain greater access to downtown businesses that might otherwise be bypassed on freeway routes.[6]

In addition to the concept being discussed with greater frequency as a viable mechanism for urban development, freeway structures are also reaching the end of their design lives. With most freeways having been constructed between 1950 and 1965, and many states reporting the need for major structural repairs, the lifecycle of urban freeways appears to be relatively short. Freeway repair is extraordinarily expensive, making governments reluctant to take on such financial burdens. With the cost of removal being much lower than a retrofit or a rebuild, especially in light of tightening local budgets and dwindling federal dollars, removal is becoming an attractive option for governments.[7]

While it may appear to be a clear choice when considering the benefits, the uncertainty that exists surrounding the magnitude a removal project and resulting change could have on traffic flows will undoubtedly cause resistance. Today, minimal empirical research exists to answer exactly how traffic will be accommodated when a high capacity road is removed from an urban area, yet this has not stopped many cities globally from like Milwaukee, to New York City and Seoul, South Korea, from embarking on freeway removal projects.[8] While this thesis does not explore what happens to the traffic when an urban freeway is removed, the discussion that follows can help cities interested in exploring the possibility of removing their urban freeways have a better understanding of past policy decisions and their implications on urban life, what cities around the

[6] Kraft-Klehm, "21st Century," 228
[7] Billings, Jason E., "The Impacts of Road Capacity Removal" (2011). Master's Theses. 63. http://digitalcommons.uconn.edu/gs_theses/63
[8] *Ibid*.

world are doing to address those implications, and the necessary ingredients that led to successful outcomes.

Freeways stand as a reminder to a time where high priority was given to increasing the efficiency of automobile movement. Most of the freeways were built without regard to the scars they left on urban neighborhoods, the barriers they formed, the visual blight they created, the noise they generated, and the pollution they spread.[9] Interstate 5 through Seattle, especially the downtown corridor, is no exception. The freeway and its extensive network of interchanges has become more of an obstacle than an asset to mobility. The highway stands as a barrier between the downtown core and surrounding neighborhoods. Furthermore, Seattle's downtown lacks green space and with the city currently experiencing a housing crisis, the freeway is sitting on large tracts of public land that could be used for both. With the Washington State Department of Transportation (WSDOT) avoiding its costly necessary maintenance, the future of Seattle's I-5 downtown corridor might not be so clear[10].

Figure 3 Interstate 5 through downtown Seattle

Source: http://westseattleblog.com/2014/05/traffictransit-today-thursday-updates-16/

[9] Cervero, Robert. 2006. "Freeway Deconstruction and Urban Regeneration in the United States." International Symposium for the 1st Anniversary of the Cheonggyecheon Restoration

[10] MacDonald, Douglas. "Trans-poor-tation 3: No high five for I-5", Crosscut. 15 May 2013, https://crosscut.com/2013/05/fixing-interstate5-is-washingtons-top-priority

Former urban policy advisor to President Nixon in the 1960s, David P. Moynihan argued that "more than any other single factor, it is the automobile that has wrecked the twentieth-century American city, dissipating its strength, destroying its form, and fragmenting its life."[11] The cumulative effects of designing a city for the automobile are felt in continued traffic jams, harmful environmental conditions, and dysfunctional urban districts. But cities all over the world, not just in the U.S., are now experiencing a shift towards the promotion of economic and environmental sustainability, livability and social equity through freeway removal.

1.2 Topic Relevance

The construction of the U.S. interstate system during the 1950s and 1960s, discussed further in the coming sections, was detrimental for the American urban environment. The automobile dramatically changed the urban landscape; traditional, dense walking cities were replaced by auto-oriented ones. Cars required cities to become physically larger because driving and parking required vast amounts of surface space.[12] White Flight to the suburbs caused major population loss. Traditional cities spiraled into decline and became seemingly obsolete.[13] However, recently many cities all over the world have been experiencing a renaissance.

The world's urban population is expected to increase by 1.35 billion, bringing the urban population to nearly 5 billion by 2030.[14] While a majority of the growth will happen in developing countries with populations congregating in mega-cities, here in the U.S., Americans are

[11] Mohl, Raymond A. "The Interstates and the Cities: The U.S. Department of Transportation and the Freeway Revolt, 1966–1973." Journal of Policy History 20, no. 2 (2008): 209.
[12] Norquist, John O. The Wealth of Cities: Revitalizing the Centers of American Life. Reading, Mass.: Addison-Wesley, 1998.
[13] Glaeser, Edward L, and Joshua D Gottlieb. "Urban Resurgence and the Consumer City." Urban Studies 43, no. 8 (2006): 1275-299.
[14] Seto, Karen, Burak Güneralp, and Lucy Hutyra. "Global Forecasts of Urban Expansion to 2030 and Direct Impacts on Biodiversity and Carbon Pools." Proceedings of the National Academy of Sciences of the United States of America 109, no. 4 (2012): 16083.

increasingly moving into downtowns. Today, 82 percent of Americans live in urban areas and are increasingly concentrating in mid-sized and large cities.[15] As a generation of 83 million, outnumbering the Baby-boomers, Millennials reaching adulthood have been a major factor in reshaping cities, reversing longstanding trends of urban decline.[16] Glaeser and Gottlieb believe the desire of consumers to live in cities has increased as a result of changes in technology and rising incomes that raise demand for high-end urban amenities.[17] Couture and Handbury suggest the new fondness for urban living and all its amenities – bars, restaurants, music venues, theaters, gyms, mass transit– is due to a broad cultural shift. The shift is not about the growth of these amenities, but rather a new desire to live *near* them.[18] For this reason, they believe the urban revival will be long-lasting. Research also demonstrates that a reduced tolerance for commuting is another factor for urban regeneration. Because of the growing population of high-income households who work long hours, Edlund, Machado and Sviatschi have found that these populations seek shorter commutes to save lost time.[19] However, Millennials have not been the only generation moving into the central city. Retired Baby-Boomers and empty-nesters have taken them into a life-cycle stage where down-sizing and higher-density housing is preferred.[20] Many of the urban amenities built to serve the growing population of Millennials are also attractive to empty-nesters.[21]

New living habits of Millennials and Baby Boomers, delays in starting families, a tougher home-buying market, and an aversion to long commutes with traffic congestion have all potentially

[15] Boyd, Bret. "Urbanization and the Mass Movement of People to Cities", Grayline Group. 27 March 2018, graylinegroup.com/urbanization-catalyst-overview.
[16] Myers, Dowell. "Peak Millennials: Three Reinforcing Cycles That Amplify the Rise and Fall of Urban Concentration by Millennials." Housing Policy Debate 26, no. 6 (2016): 928-47.
[17] Glaeser, et al., "Urban Resurgence."
[18] Couture, Victor, and Jessie Handbury. Urban Revival in America, 2000 to 2010, 2017.
[19] Sviatschi, Maria. "Bright Minds, Big Rent: Gentrification and the Rising Returns to Skill." 9502 (2015).
[20] Myers, Dowell, and John Pitkin. "Demographic Forces and Turning Points in the American City, 1950-2040." The Annals of the American Academy of Political and Social Science 626, no. 1 (2009): 91-111.
[21] Myers, "Peak Millennials," 3

altered cities in recent years.[22] An increase in urban density can also be attributed to the significant investment by cities in infrastructure and transportation.[23] However, while Couture and Handbury believe the growth of cities will be long-lasting, Myers warns that city leaders should not grow complacent about retaining their Millennial residents.[24] He does, however, believe new waterfront access, park amenities, and increased attention to public safety, all aspects that can be supported by freeway removal projects, might help reinforce population growth. By maximizing the value gained from these new urban populations, planners, developers, and city leaders can combat decline even if change is constant and residents are temporary.[25] It is important to keep in mind that improvements spurred by Millennials are all quality of life benefits that could be enjoyed by future urban populations.[26] In light of this growing demand for high-quality space and urban amenities, freeway removal can offer cities an opportunity to transform urban land to better reflect these demands and accommodate growing populations. Additionally, studies show that congestion is expected to worsen once vehicles reach high levels of automation. Autonomous vehicles have the potential to raise demand as their capacity increases, just as the expansion of highway capacity induces demand.[27] With this growth in cities and an understanding that congestion is expected to worsen with population growth and automation of vehicles, it will become even more important to seize opportunities that allow us to revisit how we utilize space in order to live and move within our urban environments.

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[22] Jaffe, Eric. "The Real Source of America's Urban Revival", Citylab. 23 February 2016, https://www.citylab.com/life/2016/02/urban-revival-america-college-educated-2000-2010/470415/

[23] Westcott, Lucy. "More Americans Moving to Cities, Reversing the Suburban Exodus", The Atlantic. 27 March 2017, https://www.theatlantic.com/national/archive/2014/03/more-americans-moving-to-cities-reversing-the-suburban-exodus/359714/.

[24] Myers, "Peak Millennials," 17

[25] *Ibid.*

[26] *Ibid.*

[27] David Metz. "Developing Policy for Urban Autonomous Vehicles: Impact on Congestion." Urban Science 2, no. 2 (2018): 33.

Urbanization comes with new challenges as well. It results in continued development, larger cities that require a new set of transportation and other infrastructure responses. Public officials and planners, in the upcoming decades, will face increasing pressure to create new infrastructure, adapt old infrastructure, revisit priorities and generate fresh policies that support larger populations in ways that promote livability and sustainability. With the Unites States' infrastructure graded as a D+ average, according American Society of Civil Engineers, and a likelihood that it will take nearly $4 trillion by 2020 to fix, cities all across the country are looking for new and diverse solutions. Cities face chronic traffic congestion, energy overuse, severe environmental pollution, and subsequent climate change that may only worsen as urban populations increase. Further, some believe that incorporating urban freeway removal as a priority within national transportation policy will not only help create more efficient, sustainable, and prosperous cities, but it may contribute to a much-needed shift away from America's dependence on the automobile.[28] As highway congestion continues to worsen, the pressure for alternative projects seems likely to increase, setting the stage for new campaigns to enhance their feasibility by developing new funding streams and relaxing regulatory constraints or both.[29]

1.3 Research Question

The nation's Interstate Highway System has entered a new period of obsolescence in its lifespan. It is aging rapidly, its bridges are collapsing, costly maintenance is deferred, and traffic overwhelms its capacity.[30] Cities now find themselves at a crossroads. Does it make sense to repair freeways or repurpose them? The purpose of this thesis is to consider removal of a section of I-5's

[28] Kraft-Klehm, "21 Century," 223
[29] Altshuler, Alan A., Luberoff, David, and Lincoln Institute of Land Policy. Mega-projects : The Changing Politics of Urban Public Investment. Washington, D.C. : Cambridge, Mass.: Brookings Institution Press ; Lincoln Institute of Land Policy, 2003
[30] Mohl, "The Expressway Teardown," 89

corridor through downtown Seattle, and the research seeks to understand why it could be a viable option for improving the quality of life in the city, avoiding a budget crippling rebuild, and help facilitate more investment in mass transit in order to provide more mobility options. This study creates a framework that cities can use to begin conversations about their urban freeways.

Chapter 2 BACKGROUND AND CONTEXT

2.1 Highway Development

The nation's first limited access highway, with grade separation of cross-streets and ramps for entering and exiting traffic was New York's Bronx River Parkway of 1923. The parkway's primary function was to enable residents' escape from the dense urban core to the healthful environment of the suburbs.[31] Urban planners acclaimed these parkways and by the late 1920s, several cities were planning their own limited-access roads with the aim of relieving traffic congestion.[32] Up until the Great Depression, the federal government played a minor role in highway development, providing minimal aid to states for rural highway improvements. Localities spent more than any other level of government on road improvements, almost entirely financing the construction and maintenance of ordinary streets.[33] During the 1930s at the federal level, an interest grew in limited-access roads as well, inspired by the *autobahns* under construction throughout Germany.[34] In 1939, highways were given concrete bureaucratic form in two major highway reports prepared by federal agencies. The Bureau of Public Roads (BPR) issued *Toll*

[31] Altshuler, et al., "Mega-projects."
[32] Fotsch, Paul Mason. Watching the Traffic Go by : Transportation and Isolation in Urban America. 1st ed. Austin: University of Texas Press, 2006: 11-60
[33] Altshuler, et al., "Mega-projects."
[34] Fotsch, "Watching Traffic."

Roads and Free Roads, an early report expressing the need for a national highway system, citing that most serious traffic problems existed within cities and the federal government would need to sponsor construction within and between them. The interstate system began to take shape in 1944 with the creation of the National Interregional Highway Committee, appointed by President Franklin D. Roosevelt. The committee then introduced the second report, *Interregional Highways*, built upon the 1939 report, which mapped out a 40,000-mile highway network, with 4,000 miles of urban highways; a network very similar to the one built in the 1950s and 1960s.[35] However, wartime financial demands prevented immediate efforts to fund and construct the highway system envisioned in these documents. This would remain the case until the early 1950s.[36]

Figure 4 1944 Interregional Highways Network

Source: https://www.enotrans.org/etl-material/1944-interregional-highways-report/

The aftermath of World War II marked a dramatic shift in power to the government, whose role became economic developer of and advocate for large-scale projects.[37] After the war, automobile production resumed, car ownership boomed while many states and localities launched major highway building programs. By 1956, there were 480 freeway miles completed or under construction in the country's twenty-five largest

[35] Altshuler, et al., "Mega-projects."
[36] Mohl, R. A. (2004). Stop the road: Freeway revolts in American cities. Journal of Urban History, 30(5), 674–706
[37] Napolitan et al., "Shifting Urban Priorities," 69

cities. Nearly all of this road mileage, along with the limited-access toll roads many states had been working on had been financed without federal aid.[38] Eventually incorporating much of the *Interregional Highways* report, Congress passed the Federal Highway Act of 1956.[39] The Act called for a unified system of 41,000 miles of interstate to be built over thirteen years, stretching between and through nearly every metropolitan city. It also created the Highway Trust through a combination of federal funds and gas taxes to finance construction. Justified as an essential component to national defense, the federal government would now cover 90% of funding while states provided 10%, becoming the largest single source of federal aid ever delivered to the states by 1958.[40]

Figure 5 Futurama Exhibit, World's Fair 1939

Source http://exhibitions.nypl.org/biblion/worldsfair/image/2j6

2.2 Extension into inner-cities

Urban freeway planning began in the 1930s, as urban planners saw the urban freeway as a solution to the growing traffic congestion, resulting from the availability and popularity of the

[38] Altshuler, et al., "Mega-projects."
[39] Mohl, "Stop the Road," 677
[40] *Ibid.*

automobile, as well as a solution to urban neighborhood blight. These "blighted" neighborhoods surrounded high-valued properties in the central business districts and authorities felt they could easily be cleared out and replaced by transportation corridors.[41] Conceptions of urban freeways coincided with new urban imagery inspired by the visually stunning *Futurama* exhibit at the 1939 New York World's Fair. Portraying "cities of tomorrow" the exhibit featured modernized expressways speeding traffic through great skyscraper cities.[42] The 1939 *Toll Roads and Free Roads* report gave form to the interstate system's extension into inner-cities by conceptualizing links between highways and urban redevelopment. The report contended that proper planning of highways would facilitate slum clearance and the rebuilding along modern lines. Additionally, the Interregional Highways document of 1944 provided plans for the new limited-access highways to run through the heart of the nation's metro areas, calling for inner and outer beltways encircling the largest cities, as well as radial expressways that would tie the system together. After the passage of the Federal Highway Act, dramatic change for urban America and its declining core was on the horizon, with backing from mayors, engineers, planners, public-works officials, and downtown business and real estate owners. *Futurama*'s imagery had worked.[43]

2.3 Consequences of Urban Freeways

In 1991, Congress marked the end of the Interstate Highway Era. Since the 1970s, few new freeway miles had been added, prompting some to declare the I-105 in Los Angeles, completed in 1993, to be the final urban freeway in the U.S.[44] The artistic designs of the futuristic and technological city depicted in the *Futurama* exhibit would never be realized. Instead, a concrete

[41] Kraft-Klehm, "21 Century," 206
[42] Mohl, "Stop the Road," 676
[43] Mohl, "Stop the Road," 677
[44] Cervero, Robert, Junhee Kang, and Kevin Shively. 2009. "From Elevated Freeways to Surface Boulevards: Neighborhood and Housing Price Impacts in San Francisco." Journal of Urbanism 2 (1): 31–50

jungle of elevated and depressed freeways rammed through city neighborhoods, with highway officials expressing that housing destruction and neighborhood demolition were necessary social costs to accommodate growing traffic demands and urban revitalization.[45] But the effects of urban freeways were not as twentieth-century planners supposed. They predominately offered people a way out of cities, leaving behind declining economic and social conditions, abandoned real estate, high-unemployment rates, and a poor disadvantaged subset of the population unable to move or gain access to jobs that were shipped out of the cities.[46]

Chapter 3 METHODOLOGY

The methodology used for this thesis consists of gathering relevant research on the topic and exploring commonalities among existing examples and case studies. Organization of research, analysis and findings were then filtered through a set of questions to allow the content analysis to be synthesized into key themes for the reader. The primary method for this thesis is a literature review of historic and contemporary writings about freeways, including current public policy. I collected information through historical documents, policy documents, peer-reviewed studies, and popular journalism. Once the information was collected, two studies were conducted: a study of the previous knowledge and the primary research study.[47] The study of previous knowledge particularly consisted of reviewing and understanding the historic development of the U.S. Interstate Highway System, the subsequent freeway revolts, the policy shifts the freeway revolts helped to influence, and modern practical examples of freeway removal projects and their important dimensions. The primary research study conducted consisted of situating the

[45] Mohl, "Stop the Road," 679
[46] Kraft-Klehm, "21 Century," 207
[47] Williams, Jan. "A Comprehensive Review of Seven Steps to a Comprehensive Literature Review." The Qualitative Report 23, no. 2 (2018): 345-49.

information found from the study of previous knowledge into the context of I-5 in downtown Seattle. Planning documents from the Washington State Department of Transportation, the City of Seattle, and the Puget Sound Regional Council were among those examined. Popular journalism was also reviewed to gain an understanding of current conversations surrounding the relevant issues. Additionally, the previous knowledge study is found threaded throughout the primary research study. The literature review was chosen as the methodological focus for this thesis given that this is still very much an emerging topic with little empirical evidence as of yet.

The four questions that formed through the research process help frame the discussion in a coherent manner:

1. What defines success? – This question was chosen because throughout the research phase, many practical examples of "successful" freeway removal cases emerged. However, in order for this thesis to have a wider audience, it became important to assign meaning to the concept of "success", as it is defined in this thesis. Asking this question helps the audience better understand how success is defined in the context of this thesis. Drawing upon a few example cities and practical variables that appeared in the literature, the audience and the author now share a common definition, allowing readers to move through the analysis. This definition will be particularly helpful while the reader explores the current completed freeway removal projects and the case for Seattle's I-5 downtown corridor.
2. What conditions are necessary for success? – This question shapes an understanding of how a successful outcome can be attained. Drawing upon historical movements, policy action, and successful freeway removal examples, answering this question can help readers and cities establish a framework for freeway removal projects they may be interested in exploring. Through this research they can better understand which factors from the

community, the city, and state, helped to directly facilitate successful results. Cities can then begin to draw similarities and differences between the examples to their own contexts in order to build their framework.

3. What prevents it from being tried? – This question addresses the many barriers that exist to prevent a freeway removal project from moving forward. During the research phase it became extremely apparent how complex the topic of freeway removal can be, as freeways serve critical state and regional economic purposes that cross many jurisdictions. Additionally, freeways in urban areas are major transportation corridors and many commuters are dependent on them for trips to and from work. Inside these issues are entrenched stances embedded in power, making the issue complicated to present. Exploring the barriers will help cities prepare for and establish strategies to help overcome them.
4. What might be possible for Seattle? – This question examines the case for Seattle's I-5 downtown corridor. I-5 faces many issues already highlighted, given there is no concrete solution to the issues presented and freeway removal is rarely explored when studying alternatives, it became interesting to explore why this could be a viable option for Seattle.

Chapter 4 ANALYSIS AND DISCUSSION

4.1 What defines success?

In understanding what a successful freeway removal project consists of it is important to establish a foundation of what success looks likes. For the purposes of this thesis, success is defined as a transportation system that is comprehensive and accessible, consisting of several options for mobility including vehicles, buses, light rail, commuter rail and pedestrian and cyclist access. Within these options exists a component of safety for pedestrians and cyclists to feel comfortable

in choosing this option. Success is also defined by a more diverse use of urban land, rather than the singular use a highway serves. If a highway were removed, a successful outcome would be the implementation of a multi-modal road, if replacement was necessary, a creation of more public open space, or the use of residual land for more pressing needs such as affordable housing. In cases where there is a lack of economic development, revitalization of areas once dominated by the presence of a highway would also be considered a component of success. Additionally, in much of the literature examined, the successful outcome of many projects were dependent upon the presence of a few crucial variables discussed more in depth in the coming sections.

Road infrastructure has proven crucial to the success of urban economies, as many states are highly reliant upon their interstates for the movement of truck freight. Additionally, many routes are part of the Strategic Highway Network, which is a designated national network that is important to national strategic defense and used for emergency mobilization and peacetime movement of military vehicles.[48] However, using road infrastructure exclusively for vehicles – supported by complex networks of interchanges, entrances and exits – has made the urban transportation network in the U.S. more expensive and less efficient than necessary.[49] In Canada, the federal government has largely left transportation decisions up to the

Figure 6 Multi-modal road, Vancouver, B.C.

Source:http://hosted.verticalresponse.com/699106/df3178b4d0/253456635/8cd85dbc7a/

[48] Washington State Department of Transportation. *2017 Washington State Freight System Plan*. 2017, accessed May 14, 2018: 22 http://www.wsdot.wa.gov/publications/fulltext/freight/Freight-Plan-2017SystemPlan.pdf
[49] Norquist, "Wealth of Cities."

provincial and local governments resulting in balanced transportation systems throughout Canadian cities. Without the 90 percent federal funding U.S. cities received for interstate construction, Canadian cities spent their money on a balance of roads and transit lines that helped preserve and further enhance urban areas.[50] In places like Toronto or Vancouver, people have the choice between walking, biking, riding, or driving to almost any location in the metro area. Driving represents a choice, not a necessity.[51] Cities with strong transit systems – Toronto, New York, Boston, Chicago, Portland, and Vancouver – all have healthy economies with concentrated development. On the contrary, cities that have allowed freeways to dominate their transportation system – cities like Detroit and Houston – have also had severe suburban sprawl and in the case of Detroit, filed for bankruptcy.[52]

Public transit and amenity-oriented infrastructure have become popular public investment alternatives in order to achieve a greater quality of life. Replacing highways or highway corridors with at-grade boulevards have become promising and effective strategies for enhancing the urban setting and working towards a more

Figure 7 Highways facilitate suburban sprawl, Houston, TX

Source: https://en.wikipedia.org/wiki/List_of_Houston_highways#/media/File:45intol-10_2.jpg

[50] *Ibid.*
[51] *Ibid.*
[52] Norquist "Wealth of Cities."

sustainable future.[53] Advocates seek to relocate highways to less offensive alternative corridors, bury them in tunnels or decked-over trenches, or even dismantle them without replacement. Many of these proposals involve building wide, multi-modal, street-level, park-like boulevards that create opportunity to restore the street grid and open up large tracts of land for parks, housing, retail, cultural uses, or other redevelopment.[54] Advocates believe these projects can have lasting beneficial social and economic impacts for a city. This would create more opportunities in city center for local residents and even commuters. Local residents would gain greater access to mobility and economic opportunities within the urban core, while commuters would have better access to downtown businesses they would otherwise bypass on the freeway.

According to Kraft-Klehm in *21st Century Futurama : Contemplating Removal of Urban Freeways in the World of Tomorrow*, cities contemplating freeway removal look to completed projects for comparison and it is clear that a project's success is determined by the convergence of several variables. One variable is that the freeway is close to the end of its design life or has sustained unexpected structural damage. In most of the examples of freeway removal examined in this thesis, the roads had reached their expiration dates and were facing substantial repairs, they had already sustained damage due to age, or they were damaged in an earthquake and were forced to close immediately. As Stephan Hastrup points out in *Battle for a Neighborhood*, following a crisis or disaster, changes may occur suddenly. The routinely slow and incremental processes of bureaucracy by which cities operate may be interrupted, creating unique and brief windows of opportunity that allow for new possibilities emerge to implement shelved plans or push forward bold projects.[55] Another variable is that mobility for commuters will not be significantly impaired.

[53] Jang, and Kang. "Urban Greenway and Compact Land Use Development: A Multilevel Assessment in Seoul, South Korea." Landscape and Urban Planning 143 (2015): 160-72.
[54] Mohl, "The Expressway Teardown," 90
[55] Hastrup, S. (2006). Battle for a neighborhood. Places-A Forum Of Environmental Design, 18(2), 66-71.

While conclusions about the true impacts of freeway removal still remain somewhat unclear, in most cases of road capacity reduction the predicted traffic chaos or long-term increase in congestion never occurred.[56] In fact, in some cases road removal improved overall congestion, reducing total traffic volume in the area. Much of the literature that discusses freeway construction, maintenance, and freeway removal suggests that politics plays a major role. Kraft-Klehm also suggests that local political actors must value the benefits associated with removal over maintaining the status quo. In a few of the examples reviewed further in the coming sections, politicians such as city mayors staked their campaigns on freeway removal projects such as John Norquist of Milwaukee, who as a young legislator, fought the construction of the freeway he eventually advocated to tear down when he became mayor. A final variable necessary for success is the presence of an active group of stakeholders with a concrete development plan.[57] At times, when politicians have been unwilling to take a strong stance on the future of their freeways, communities took it upon themselves to advocate for the option they felt was best for their neighborhood or city. In the case of San Francisco's Central Freeway, after the highway suffered damage in the 1989 Loma Prieta earthquake and was forced to close, the city's elected officials were unwilling to step forward and make a decision regarding the road's future. Because of the two vastly different stakeholder groups, a low-income community in which the freeway ran through and the commuters who had grown dependent on the road, the issue seemed like a no-win. Taking a strong position one way or the other on the Central Freeway could be alienating a large block of voters, leaving the fight to remove the road largely to neighborhoods activists.[58] In addition to the importance of community advocacy during the process of freeway removal,

[56] Cairns, S., C. Hass-Klau and P. Goodwin. Traffic Impact of Highway Capacity Reductions: Assessment of the Evidence. Landor Publishing, London, 1998
[57] Kraft-Klehm, "21 Century," 229
[58] Hastrup, "Battle for the Neighborhood"

historical perspectives from the highway development era demonstrate that persistent neighborhood action has always been an extremely important component of success. While most freeway revolts were unsuccessful for many reasons, the cities that saw successful outcomes maintained strong community advocacy from beginning to end. Further, it is clear through the reviewing of other literature and examples that economic viability emerged as an important determinant of success as well. In most of the cases, cities and states were facing crippling costs associated with the necessary repairs and opted for removal because it was the cheaper option and promised a higher quality of life. The convergence of these variables create a window of opportunity. During these brief moments, critical questions emerge. Can this moment be sustained long enough to create real change? Who will be the decision-makers? And will the vision be compelling enough to garner the necessary political momentum to implement?[59]

4.2 What conditions are necessary for success?

With meaning and understanding of what success looks like in the context of a freeway removal project, it becomes necessary to further explore the conditions necessary for a successful outcome. Presented in this section is a discussion of the historic freeway revolts that resulted from interstate development within cities. The purpose of highlighting this history is to provide context for the important citizen advocacy that took place during this time period that ultimately played a role in influencing a shift in federal and state transportation policy. The policy changes and recent federal programs demonstrate a distinct shift towards viewing transportation within a wider context, a context that allows for more flexible spending for transportation alternatives. These

[59] Hastrup, "Battle for the Neighborhood"

shifts in policy have allowed cities to take on bold projects that ultimately reject highway development as a singular approach to transportation, and have paved the way for many cities to remove urban freeways. Further, there has also been a shift in advocacy noted in the literature examined, with some authors pointing out the growing sense of advocacy for highway removal within those who hold substantial media influence and among those who now hold decision-making power, such as city mayors and Department of Transportation secretaries. Several freeway removal cases that have taken place around the world are also examined in this section to better understand how each case is unique in its goals, approach and outcome, just as the freeway revolt successes were with advocacy and policy playing crucial roles in each. The highway development era, and the subsequent oppositions that rose, influenced policy reactions that are reflected in the current U.S. transportation policy climate. Understanding this and investigating completed freeway removal projects, it becomes possible to better understand the variables and conditions that help garner momentum for a project and how that momentum can lead to a successful outcome or at least help cities begin to ponder more options for their urban freeways.

4.2.1 Freeway Revolts

Today's freeway demolitions are somewhat of a legacy to the widely recounted freeway revolts of the 1950s and 1960s. Many parallels can be drawn between the two eras, and what made many freeway revolts successful are aspects that have also made freeway removal projects successful, making it important to understand how important elements such as citizen advocacy and policy shifts were leveraged to affect change.

By 1964, 2,612 miles of urban freeways had been built with another 1,600 miles under construction.[60] Officials expected that central cities would need to be partially restructured to accommodate the new infrastructure, but they did not anticipate the major surgery it subjected cities to on a scale without precedent in U.S. history.[61] However, planners struggled with how to make urban freeways compatible with existing urban fabrics. They were forced to compromise visions of greenways, seen outside of cities, given the need to traverse dense areas, running up against the challenge of routing through neighborhoods. Between 1956 and 1967 more than 300,000 households across the U.S. were displaced to make room for federally aided highways.[62] These were primarily poor and minority households, in part because officials sought low-cost rights of way, targeting areas that would be politically weak.[63] However, for those living in urban areas at the time, the social costs of urban freeways were too high. They seemed to solely benefit white suburbanites at the expense

Figure 8 Construction of I-81 through the 15th Ward, the center of Syracuse's black population in Syracuse, NY during the 1960s

Source: Onondaga Historical Association

[60] Altshuler, et al., "Mega-projects."
[61] *Ibid.*
[62] *Ibid.*
[63] *Ibid.*

of low-income city residents, and the razing and uprooting of center-city neighborhoods made the racial and class implications of freeway construction inescapable. [64]

With minority and low-income populations receiving the brunt of the consequences urban freeway building came with, grassroots opposition became common during this time period.[65] Typical of the countercultural 1960s, the anti-freeway movement spread nationally as citizens grew fed up with mass housing demolition, community destruction, and environmental damage; pitting grassroots efforts against state and federal highway engineers and authorities who used top-down decision-making to establish the interstate system's routes and construction. Highway builders viewed public hearings as a method of disseminating information to citizens, not as a place for them to voice concern.[66]

Figure 9 Freeway Revolts in San Francisco

Source: http://www.foundsf.org/index.php?title=The_Freeway_Revolt

[64] Altshuler, et al., "Mega-projects."
[65] Cervero et al., "From Elevated Freeways," 32
[66] Kraft-Klehm, "21 Century," 213

Rather than negotiate or compromise on route location, highway officials sought to forge ahead with the hope to build quickly before opposition united and politicians caved to the outrage.[67] Homeowners and neighborhood groups usually came up against the rigidity of government who were unwilling to acknowledge or yield legal authority.[68]

However, in San Francisco for example, the construction of multiple freeways became

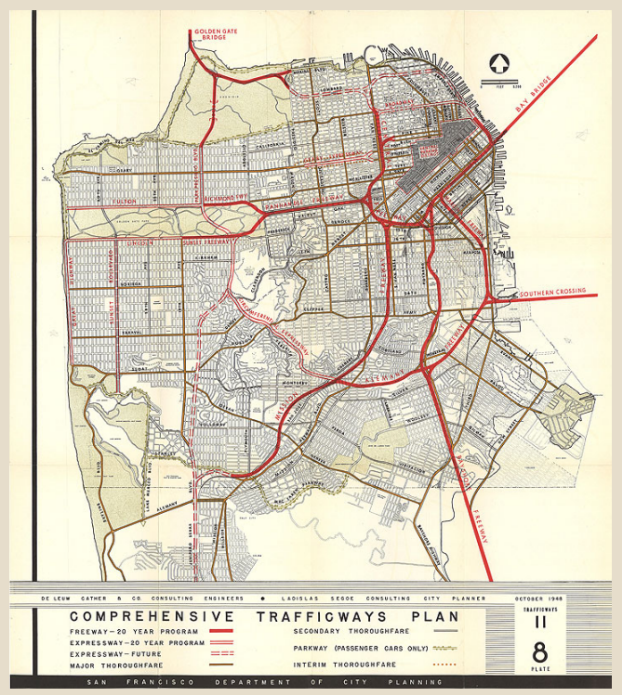

Figure 10 1948 Freeway Plan for San Francisco

Source: http://www.foundsf.org/index.php?title=Freeways_Never_Built,_or_Unbuilt_after_1989_quake

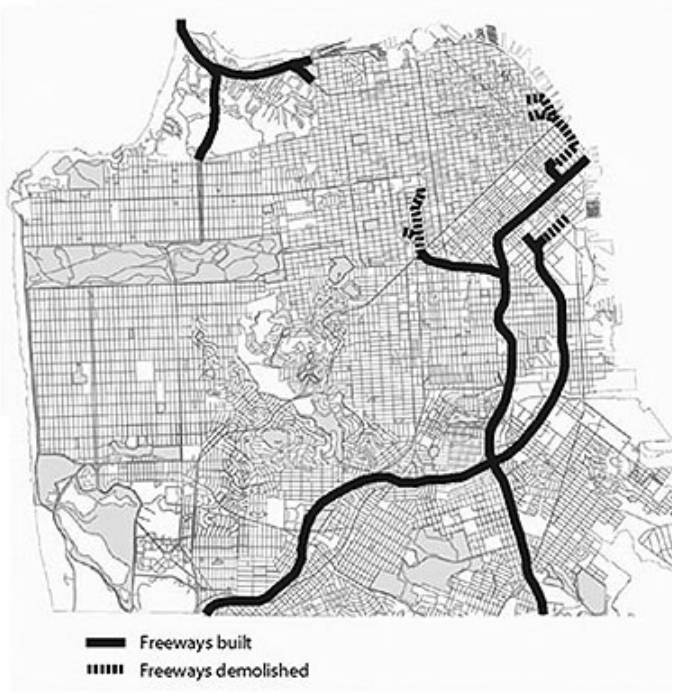

Figure 11 Freeways actually built and demolished in San Francisco

Source: Eric Fischer https://www.flickr.com/photos/walkingsf/sets/72157622139053795

sidetracked by a powerful coalition of neighborhood associations, environmental groups, and major media outlets. San Francisco's original freeway master plan was crafted by the California Department of Highways in 1948 and included miles of freeways that would surround and cross

[67] Mohl, "Stop the Road," 678
[68] *Ibid.*

the city.[69] The Embarcadero Freeway was planned to be a double decker running along the northern waterfront to connect the Golden Gate Bridge with the Oakland Bay Bridge, but when residents became enraged after witnessing the destructive results, only 1.2 miles of the planned Embarcadero was ever built.[70] By 1959, even San Francisco's board of supervisors had withdrawn their support for any new freeway construction.

In some cities, freeway revolts took on added significance, due to the coinciding civil rights movements, when black neighborhoods were targeted by officials. Baltimore's freeway revolt saw some successes due to delays in freeway building as a result of political bickering. When highway construction finally began in Baltimore, the nation was in the throes of the fierce civil rights movement, linking the city with a nation-wide movement. Ultimately, the freeway fighters in Baltimore were able to use new laws, rules, and procedures to their advantage to successfully litigate and defeat some construction.[71]

4.2.2 Policy reactions to freeway revolts

Given the need for continuous rights-of-way several hundred feet wide, most highway engineers deemed it infeasible to reduce impact, consisting of housing demolition, relocation, and massive construction efforts.[72] When faced with opposition, they developed a uniform and hard-lined stance that their job to build highways, housing and relocation issues were the responsibilities of someone else. But by the mid-1960s it became increasingly more difficult for highway agencies to rigorously sustain this position.[73] By the 1970s, those advocating for freeway revolts had developed a national organizational structure as activists of all kinds networked and exchanged

[69] Mohl, "Stop the Road," 679
[70] Billings, Jason, Norman W. Garrick, and Nicholas E. Lownes. 2013. "Changes in Travel Patterns Due to Freeway Teardown for Three North American Case Studies." Urban Design International 18 (2): 165–81.
[71] Mohl, "Stop the Road," 689
[72] Altshuler, et al., "Mega-projects."
[73] Mohl, "Stop the Road," 679

information, influencing policy responses from Congress. Transportation legislation and implementation of the 1960s and 1970s reflected a gradual shift from a construction-centric approach to highways as the savior of the urban core to one of transportation planning within a greater urban context.[74] The Federal Highway Act of 1962, for the first time, required the integration of highway planning and urban planning by requiring federally funded projects be based on a comprehensive transportation planning process that works with state and local communities. However, this did not require a revisit to projects already planned as of 1955, making the new mandates rather superficial.[75] Creation of the cabinet-level U.S. Department of Transportation (DOT) in 1966 was an attempt to rationalize and concentrate power. Before Bureau of Public Roads (BPR) officials had been operating freely, but with this restructuring federal highway engineers were subjected to a level of unprecedented administrative supervision and control. The state level DOTs were replacing highway departments and governors were taking control of state highway policy through appointment and funding powers.[76] The creation of the DOT seemed to indicate a new public policy realm, one in which transportation policy and planning became more balanced and multimodal in nature. Alan Boyd, the first DOT secretary seemed willing to challenge basic BPR highway engineering strategies by encouraging more citizen involvement and calling for a more balanced system, asserting that highways needed to be an integral part of the urban environment. Within a year of taking office at the DOT, Boyd had become the most effective and visible spokesman for the freeway revolt.[77]

The Federal Highway Act of 1968 created a national policy seeking the preservation of public parks, wildlife refuges, and historic sites with an additional mandate for relocation and

[74] Kraft-Klehm, "21 Century," 213
[75] Altshuler, et al., "Mega-projects."
[76] Mohl, "Stop the Road," 680
[77] *Ibid.*

housing replacements for displaced citizens from highway construction, backed with considerable funding.[78] Additional environmental legislation came on board quickly after in the form of the National Environmental Policy Act (NEPA) of 1969 that now required all federally aided projects to perform an environmental impact statement. Further, the 1970 amendment to the Clean Air Act created more regulations restraining highway builders. Together, these two pieces of legislation opened up new opportunities of freeway fighters to litigate. The Nixon administration also seemed receptive to citizen concerns that led to the Federal Highway Act of 1973 which opened up federal funds from the Highway Trust to be used for public transportation rather than just for interstate construction.[79]

The chronicled freeway revolts offer up a fascinating account of how cities reacted differently to urban freeway construction. Each city has its own history, geography, demographics, political structure, neighborhood patterns, and political culture. These variations help explain why freeway revolts had different histories and diverse outcomes. But the successful revolts shared several commonalities and without them, it was very likely freeways would have been built. Ordinary citizen involvement and persistent neighborhood action was extremely important. Committed local leaders, and cross-city, cross-class, and interracial alliances were necessary in bringing about high-levels of attention over a sustained period of time.[80] The movement also needed strong support from a least some local politicians and from influential newspapers and journalists to increase visibility.[81] Access to litigation measures also became a key to success because it provided the ability to delay land acquisition and construction for years.[82] However,

[78] Kraft-Klehm, "21 Century," 214
[79] *Ibid.*
[80] Mohl, "Stop the Road," 676
[81] Mohl, "Stop the Road," 679
[82] *Ibid.*

Mohl asserts that it is important not to romanticize the freeway revolts. They were successful only to the extent they were able to use tools provided by the government.[83] Interestingly, governments that advocated for and financed the majority of highway construction operation, began to legitimate the freeway fighter's cause. He states that "despite all the talk among road engineers about simply serving traffic needs, in the highway field, politics was always in the driver's seat."[84]

4.2.3 Policy Shift

Congress marked the end of the interstate era in 1991 by passing the Intermodal Surface Transportation Efficiency Act (ISTEA). The Act represented a shift away from state governments that favored traditional automotive projects to accommodate vehicular demand over a more local or regional focus by requiring greater participation of Metropolitan Planning Organizations (MPOs). MPOs were created with the purpose of incorporating a regional perspective in transportation planning and are made up of local government representatives and transportation authorities.[85] Funds became attached to a requirement that MPOs work together with state and transportation officials to create long-term transportation improvement plans. ISTEA also greatly relaxed categorical restrictions on the use of highway aid, giving states more flexibility and autonomy to make more localized decisions than ever before.

ISTEA authorized $124 billion for highway grants for 6 years, but the acts creation represented a long-standing shift toward rehabilitation and reconstruction from new construction. By 1995 about half of all spending on highways was for these purposes. In addition to highway grants, it also contributed $31 billion for urban mass transit and $2.4 billion for projects like bike path implementation and historic and scenic preservation. Further, ISTEA specified that highest

[83] *Ibid.*
[84] Mohl, "Stop the Road," 700
[85] Kraft-Klehm, "21 Century," 217

priority of surface transportation spending was to facilitate the achievement of clean air objectives; making ISTEA widely praised.[86]

ISTEA's replacement, the Transportation Equity Act for the 21st Century (TEA-21) of 1998, went further, allowing even more federal contributions to be used for alternative transportation projects and giving more autonomy to local governments and planning agencies.[87] The Act, still allowed for more highway spending, in the form of $162 billion for another 6 years, but it increased spending for mass transit to $36 billion and another $9 billion, furthering the trend of earmarking funding for "special projects".

Another federal program worth noting is the Transportation Investment Generating Economic Recovery discretionary grant (TIGER). Since 2009, cities contemplating highway removal projects have had the opportunity to apply for the TIGER grant. Projects selected for the grant have typically been multi-modal, multi-jurisdictional, or otherwise tricky to find funding for through traditional methods. Projects applying for the TIGER grant must demonstrate valuable long-term outcomes, such as minimizing the life-cycle costs of repairs and maintenance, contribute to the nation's economic competitiveness, foster livable communities, promote environmental sustainability, and improve safety. While only four grants in total have been awarded to freeway removal projects, among the 40-60 projects submitted each year, it would appear that federal support for highway teardowns is more than just symbolic.[88]

These federal programs highlight the way officials are now viewing past transportation policy, and what transportation's future role will be in revitalizing urban cores, reknitting neighborhoods once divided, and how it might be used to help residents gain access to

[86] Altshuler, et al., "Mega-projects."
[87] Kraft-Klehm, "21 Century," 217
[88] Mohl, "The Expressway Teardown," 96

health care, education, great public spaces, and better jobs.[89] The public investments that have most profoundly shaped urban places in the past half century have occurred within the frames of federal and state programs. Local interests have routinely been active members of supportive coalitions for these programs, and then played central roles in advancing specific projects.[90] With dwindling funds and varying priorities, local governments and organizations will again need to lobby higher-level governments to affect action, but this time in the interest of protecting their local priorities.

4.2.4 Modern Forms of Advocacy for Freeway Removal

The expressway teardown movement that began in the 1970s with the demolition of Harbor Freeway Drive, stemmed from a fundamental shift in national transportation politics. This new anti-freeway movement has a much wider base of support in most cities than the freeway revolts of the 1960s. Many of those promoting the freeway teardowns are the decision makers now. Preservationists, environmentalists, and real estate interests see opportunities to revive downtowns, restore neighborhoods, rebuild old street grids, and eliminate air and noise pollution. Because transportation policy has been decentralized, these multiple voices have a more powerful impact than during the freeway revolts. Those promoting freeway removal also have a greater influence now because they rely heavily on the internet to inform and persuade. For instance, Congress for New Urbanism (CNU) has developed the "Highways to Boulevards Initiative" annually identifying new highways in a feature called *Freeways without Futures.* The initiative seeks to empower those who may be interested in teardown projects in their communities, giving

[89] Bigelow, Pete. "The Future of Neighborhoods: Removing Urban Freeways Gains Fresh Traction", Popular Mechanics. 20 September 2016, https://www.popularmechanics.com/culture/a23121/future-of-neighborhoods-removing-urban-freeways/

[90] Altshuler, et al., "Mega-projects."

Figure 12 Denver's I-70 corridor

Source: http://www.coloradoindependent.com/160187/i-70-expansion-explained

them a starting point. CNU sees this campaign, and the highways selected, as opportunities for progress highlighting that these freeways do not justify their consequences. Each year highways all over the country are selected. In 2017 it was the Scajaquada Expressway in Buffalo, I-345 in Dallas, 1-70 in Denver, I-375 in Detroit, I-980 in Oakland, Route 710 in Pasadena, the Inner Loop in Rochester, I-280 Spur in San Francisco, I-81 in Syracuse, and Route 29 in Trenton. Considering this list alongside the freeway removal projects that have been completed here in the U.S., examined in the coming section, it is clear freeway removal is becoming even bolder in its targets. CNU is showing cities that they are not without options, within their existing margins, they can create policy and make tough decisions that add value and can accommodate people, commerce, and sustainability, not just cars.[91]

In looking at the historical context of the interstate system and the dire consequences it had on urban communities, the ongoing discussions about highway removals and locations are not about traffic and transportation. They are about the communities that have suffered. For the first time in the 60 years since the interstates arrived, needs of commuters and suburbanites are

[91] Norquist "Wealth of Cities."

beginning to hold less sway. Decisions regarding America's cities are increasingly prioritized for the people who live in them.[92]

4.2.5 Freeway Removal Cases and Dimensions Within

Examining a set successful freeway cases that have taken place in the U.S. is helpful to demonstrate an understanding that there is no "one size fits all" solution, and that cities contain their own unique set of circumstances and issues being addressed. Each city approach their projects differently because of this. Providing these examples can help cities identify where their situations may be similar and where they may be different, and how to move approach a project based on this information.

Harbor Drive Freeway: Portland Oregon

The first freeway removal project embarked upon in the U.S. was the deconstruction of the Harbor Drive Freeway in Portland, Oregon. Originally built in 1942, as a three-mile long, four lane, at-grade road along the Willamette River, the freeway existed as physical barrier between downtown and the waterfront. By 1968, residents were looking for more open space by along the river. While the state was exploring a widening and relocation, a task force was assembled to examine removing and replacing the freeway. The team proposed three alternatives; cut and cover, widening and realigning, or relocation and widening. The team had not even considered a removal until mounting public pressure demanded it.[93] The proposal to remove the freeway gained support when I-405 was completed in 1973 and connected to I-5. In 1974, the freeway was finally demolished and replaced with a 37-acre park. At its peak, it carried 25,000 cars a day, but after its removal, there were no discernable negative effects to traffic flow in the surrounding area. This

[92] Bigelow, "Future of Neighborhoods."
[93] "6 Case Studies."

was potentially due in part to the freeway's removal being integrated into a comprehensive plan to better manage traffic in the city. It was paired with a conversion of all downtown streets into one-ways, synchronization of traffic lights, and a decrease in speed limits.[94] In addition to the 37-acre park, other major development projects were completed in the area after removing, increasing tax revenue for the city. The area also saw an increase in property values. By 2002, they had tripled since 1974 and property value growth in the area was increasing faster that the rest of Portland by 7 percent.[95]

[94] *Ibid.*
[95] Billings, "The Impacts"

Figure 15 Location of Harbor Drive Freeway before demolition
Source: Google Earth

Figure 13 Harbor Drive Freeway, Portland Before

Source: https://reclaimingoldwestbroad.org/case-studies/portland-harbor-drive/

Figure 14 Harbor Drive, Portland After

Source: https://reclaimingoldwestbroad.org/case-studies/portland-harbor-drive/

Westside Highway: New York, New York

Constructed in 1948, New York City's Westside Highway, was a six-lane, five-mile long freeway running along the Hudson River. The highway was an elevated structure that ran over the at-grade West Street, acting as a barrier between the city and the waterfront. At its peak, the highway carried 140,000 cars a day. By the 1960s, the highway was in terrible shape. In 1973, a cement truck fell through the road causing a 60-foot section of the highway to collapse, forcing a partial closure.[96] Ultimately, the structure was demolished by 1989. When the highway closed in 1973, 53% of the traffic that utilized the corridor essentially disappeared, reducing the total traffic volume in the area. In 1993, the city decided to improve West Street with landscaped medians, a bike path, and a park along the river. The project was completed in 2001. West Street has three to four lanes in each directions carrying between 65,000 and 139,000 cars a day.[97]

[96] Kraft-Klehm, "21 Century," 219
[97] Billings, "The Impacts"

Figure 16 Location of Westside Highway before demolition

Source: Google Earth

Figure 17 Westside Highway, NYC, NY Before

Source: http://digitalcollections.archives.nysed.gov/index.php/Detail/Object/Show/objectid/3512

Figure 18 West Street, NYC, NY After

Source: http://www.skatecity.com/nyc/where/manhattans.html

Park East Freeway: Milwaukee, Wisconsin

Milwaukee, Wisconsin began construction on the Park East Freeway in the 1960s, with the first section opening in 1971. Groups of environmentalists, the local community, and even a young future mayor of Milwaukee, John Norquist, protested its construction because it cut the city off from the waterfront.[98] Due to the uprising, the remainder of the freeway was never constructed. However, the one section that was constructed, carried only 54,000 vehicles a day at its peak but still acted as a major barrier in the city because it interrupted the street grid.[99] Additionally, the limited-access freeway only had three downtown exits, forcing traffic into just three intersections. By the 1990s, the freeway was only 30 years old and in need of significant repairs. The cost for repair being estimated at around $100 million and the cost of removal being at just $25 million, helped convince the governor to proceed with demolition in 2003. It was ultimately replaced by McKinley Boulevard, an at-grade road with four lanes that has reconnected the street grid and carries around 19,000 vehicles a day. Between 2001 and 2006, the average land values per acre in the area saw an increase of 180%.[100] Additional land made available was used for housing, shops, and offices.[101]

[98] "6 Case Studies."
[99] *Ibid.*
[100] Billings, "The Impacts"
[101] Cervero et al., "From Elevated Freeways," 32

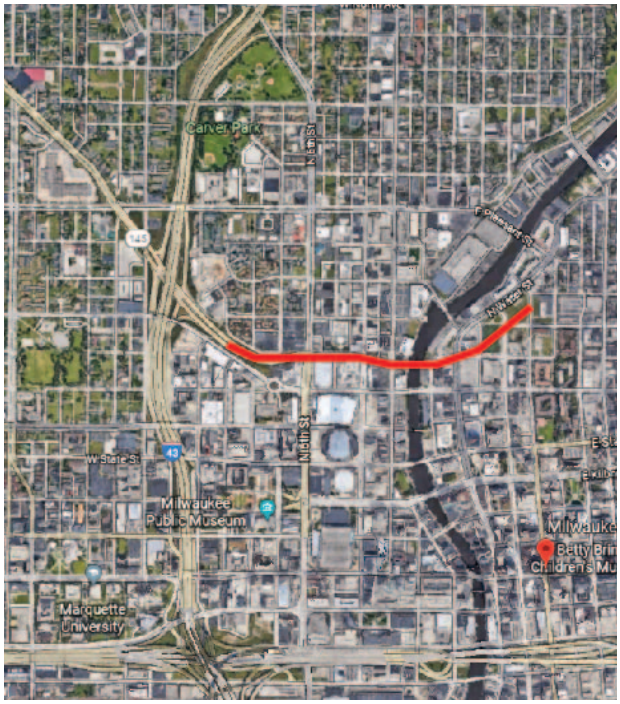

Figure 19 Location of Park East Freeway before demolition

Source: Google Earth

Figure 21 Park East Freeway, Milwaukee, WI before

Source: https://www.cnu.org/what-we-do/build-great-places/park-east-freeway

Figure 20 Park East Freeway clearance, Milwaukee, WI after

Source: Source: https://onmilwaukee.com/buzz/articles/parkeastpush.html

Embarcadero Freeway: San Francisco, California

San Francisco, California is home to two of the most widely discussed freeway removal projects in the U.S. The Embarcadero Freeway was constructed in 1958, carrying around 100,000 cars at its peak, including the traffic on the surface street below. During the 1989 Loma Prieta earthquake, the freeway sustained severe damage, forcing a closure. Through the course of extensive public debate, it became evident that the majority of San Franciscans wanted the freeway permanently removed. Eventually CalTrans agreed, as the most economical decision was a tear-down and boulevard replacement. [102] The 1.2-mile long section was removed in 1991. The removal opened back up the waterfront to the rest of the city and spurred new development in the area. In its place, a landscape boulevard was created; paired with a pedestrian promenade, parks, and a trolley line that carries 20,000 people a day at its peak. No traffic chaos ensued, contrary to expectations at the time and today, the boulevard carries 50,000 vehicles a day. Improved signal timing, creation of one-way couplets, and increased transit service helped mitigate traffic impacts.[103] Further, there was a 54 percent increase in housing units in the "impact zone" (the area examined closest to the new road) and 31 percent in the "control zone" (the study area further from the road) with a 75 percent increase in transit commute trips during the 1990s in the "impact zone" and a spike in property values.[104]

Figure 11 Embarcadero After : http://shift-transports.ch/tamarabozovic-us-can-visits-report-complete-dec2017/?lang=en

[102] Cervero et al.,"From Elevated Freeways," 35
[103] *Ibid.*
[104] Billings, "The Impacts"

Figure 22 Embarcadero Freeway, San Francisco, CA before demolition

Source: http://vox.rhizomicon.com/2009/07/san-francisco-daylightings.html

Figure 23 Embarcadero Freeway, San Francisco before

Source:http://www.slate.com/articles/life/transport/features/2010/unbuilt_highways/san_francisco_the_embarcadero_freeway.html

Figure 24 Embarcadero Boulevard, San Francisco after

Source: http://shift-transports.ch/tamarabozovic-us-can-visits-report-complete-dec2017/?lang=en

Central Freeway: San Francisco, California

From San Francisco comes another example of freeway removal. The Central Freeway was constructed during the 1950s as a 0.8-mile long elevated structure. At its peak it carried approximately 100,000 cars a day.[105] The freeway was also damaged during the Loma Prieta earthquake in 1989. When it closed, CalTrans predicted there would be bumper-to-bumper traffic for 45 miles east and south, warning commutes could increase as much as two hours.[106] Local politicians and citizen activists began to propose alternatives for the remaining elevated structure in lieu of the state's planned seismic retrofit.[107] It was removed in phases between 1989 and 2003. Its replacement is Octavia Boulevard, a multi-way boulevard constructed in 2006 that carries approximately 52,000 vehicles a day. It consists of four lanes for through traffic and two lanes for local car and bike traffic, separated. Most of the traffic redistributed to another freeway or other streets. Additionally, expansion of housing, public parks, and mass transit were included as part of the redevelopment and parking was intentionally limited to make the area more pedestrian and multi-modal.[108]

[105] Kraft-Klehm, "21 Century," 220
[106] Cervero, "Freeway Deconstruction."
[107] Kraft-Klehm, "21 Century," 220
[108] Billings, "The Impacts"

Figure 27 Central Freeway, San Francisco before demolition

Source: Jason Billings + Google Earth

Figure 26 Central Freeway, San Francisco, CA before

Source: https://www.sfgate.com/news/article/Timeline-A-look-back-at-Octavia-St-and-the-2680322.php

Figure 25 Octavia Boulevard, San Francisco, CA after

Source: https://www.quora.com/How-did-Octavia-Boulevard-in-San-Francisco-get-designed

Cheonggye Elevated Highway: Seoul, South Korea

Seoul, South Korea represents the boldest freeway removal project embarked upon yet. The Cheonggye Elevated Highway was constructed in the 1970s in place of the Cheonggyecheon stream that was placed underground between 1958 and 1976. The freeway was four lanes and about 3.6 miles long, with four additional lanes of traffic in both directions on either side of the at-grade road adjacent to the elevated portion of the freeway. At its peak, including both roads, the freeway carried about 168,000 cars a day. As many urban freeways were seen prior to their construction, this structure in Seoul was supposed to be a symbol of modern progress until it became the nosiest and most congested part of the city.[109] In 2005, then Mayor Lee Mung-bak staked his political future on the removal of the Cheonggyecheon elevated expressway, bringing the buried stream back to the surface and creating a linear park in its path. Mung-bak claimed the project to be "a new paradigm for urban management in the new century" and wanted to create a city where "people come first, not cars."[110] Since the mid-1990s, Seoul has made transit an increasingly more attractive option, and the removal of this freeway served as another component of that plan.[111] A robust comprehensive traffic management plan was implemented in the city consisting of peak hour tolls for entering the city with less than three passengers, fee increases for parking, and discounts on tolls for drivers in exchange for not driving into the city one weekday a week. Gas taxes were increased and the city's bus system was completely restructured and coordinated schedules with the subway system.[112] Additionally, the city announced in 2004 that it

[109] Billings, "The Impacts"
[110] Cervero, "Freeway Deconstruction."
[111] "6 Case Studies."
[112] Billings, "The Impacts"

would be reducing the public parking supply downtown, and has lowered parking requirements for commercial development.[113]

Figure 29 Cheonggye Elevated Highway, Seoul, S. Korea before

Source: https://landscapeperformance.org/case-study-briefs/cheonggyecheon-stream-restoration

Figure 28 Cheonggyecheon stream, Seoul, S. Korea after

Source: https://blog.onedaykorea.com/tag/cheonggyecheon-stream/

[113] "6 Case Studies."

Riverfront Parkway: Chattanooga, Tennessee

Riverfront Parkway in Chattanooga, Tennessee was constructed in the 1960s as a four-lane highway intended primarily for industrial use along the river.[114] Once industry began to decline in the area, the movement in and out of the city the freeway facilitated started to hurt downtown businesses contributing to the overall decline of Chattanooga. With Riverfront Parkway becoming obsolete and acting as a barrier between the city and its waterfront, efforts became focused on removing the piece of infrastructure. At its peak the freeway carried 20,000 cars a day.[115] The replacement road was reduced to two lanes in some sections, and a four-lane urban boulevard in others areas. The new design allowed for easily access to the waterfront by creating a street that was much easier to cross, and that helped restore the overall street grid.[116] Where there was once only two access points from the freeway into downtown, there were now six street intersections that helped distribute traffic more evenly,

reducing congestion in the area.[117] Recreational parks were also created alongside the new boulevard, helping to attract more people and the possibility for more future development. [118]

[114] "6 Case Studies."
[115] Billings, "The Impacts"
[116] "6 Case Studies."
[117] Billings, "The Impacts"
[118] "6 Case Studies."

Figure 31 Riverfront Parkway, Chattanooga, TN before

Source:https://www.cnu.org/highways-boulevards/model-cities/chattanooga

Figure 32 Riverfront Parkway, Chattanooga, TN after

Source: https://www.cnu.org/highways-boulevards/model-cities/chattanooga

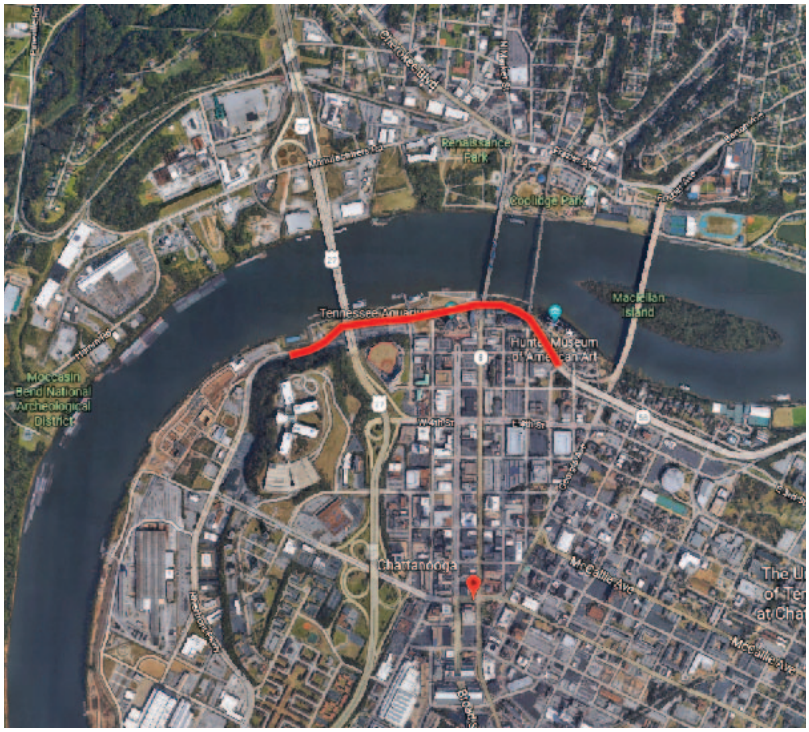

Figure 30 Riverfront Parkway, Chattanooga, TN before transformation

Source: Google Earth

Highway	Location	Cars/Day	Elements Gained
Harbor Drive Freeway	Portland, OR	25,000	Removal of a physical barrier; creation of open space; comprehensive traffic plan; increased tax revenue and property values
Westside Highway	NYC, NY	140,000	Removal of a physical barrier; improved surface street; reduced traffic volume in area; creation of open space
Park East Freeway	Milwaukee, WI	19,000	Removal of a physical barrier; economic viability; economic development
Riverfront Parkway	Chattanooga, TN	20,000	Removal of a physical barrier; reduced congestion; reknitting urban fabric; creation of open space; new development potential
Embarcadero Freeway	San Francisco, CA	100,000	Removal of a physical barrier; new development; improve safety; reduction in traffic volume in area; new housing; improved transit; property value increase
Central Freeway	San Francisco, CA	100,000	Multi-modal boulevard; traffic volume reduction; new housing; creation of open space
Cheonggye Elevated Highway	Seoul, South Korea	168,000	Restored stream; creation of open space; reduction in traffic volume; comprehensive traffic plan

The freeway revolt era that took place during the construction of the interstate system played a crucial role in influencing a shift in federal and state transportation policy. This shift, along with more recent federal programs have created a wider context through which transportation policy is viewed. These changes on the state and federal level have encouraged cities to take on bold projects like freeway removal. It also became apparent in reading about the revolts that advocacy, whether citizen or political, was crucial for a successful outcome. Additionally, through the investigation of removal examples the same held true. The explored 7 examples of removal also help answer this question by demonstrating that *many* factors contributed to the success of these projects, because each city is different. Each has its own history of highway

development, with varying social, economic, and environmental conditions. It became clear there is no "one size fits all" approach to freeway removal projects, however exploring the conditions present can help cities identify how their situations may be similar or different which will aid in the development of their own unique framework. While these projects help understand how cities were able to remove their urban freeways and are useful in developing a strategy for future removal projects, they differ greatly from I-5. None of the freeways served as crucial regional arteries or carried the amount of daily traffic I-5's downtown Seattle corridor carries, making it difficult to imagine how a section of I-5 could be removed without solid grasp of how it would affect regional transport and how the traffic would adapt.

4.3 What prevents it from being tried?

Freeway removal projects are very complex and difficult to embark upon for many reasons. Through an exploration of available literature on this still emerging topic, it is clear that many barriers exist for cities that ultimately prevent projects from being attempted or even discussed. Jurisdiction is one of the main issues often discussed because within project jurisdiction lies the issues of funding control, misalignment of priorities between different levels of government, and political perception. Competing interest groups also serve as a major barrier because there exists a dichotomy between those who enjoy the convenience automobiles offer and those who suffer because of the negative effects they generate. However, perhaps the most common barrier encountered is concern over where the existing traffic will go once a road is removed or its capacity greatly reduced.

4.3.1 Jurisdiction: Funding, Priorities, and Politics

Moving Ahead for Progress in the 21st Century (MAP-21) is the most recent transportation bill, allocating nearly $40 billion for each fiscal year 2013 and 2014 to fund federal-aid highways

and highway safety construction programs. MAP-21 is the first long-term highway authorization enacted since 2005.[119] The dollars once put forth by the federal government with the Federal Highway Act of 1956, have largely disappeared today. The Federal Highway Trust Fund, largely fueled by the gasoline tax was relatively dried up for years before MAP-21. The U.S., for the most part, has stopped funding and fixing its infrastructure.[120]

As the transportation system has grown and become more complex, transportation decision-making has become more difficult, projects have become more costly, and revenue challenges have grown. Today, there seems to be a growing dichotomy between state and local priorities due to tightening budgets and local and regional considerations. U.S. local governments are far from having exclusive jurisdiction over their territories, and even the powers they do exercise are subject to laws and regulations of higher-level governments. But in recent decades, federal and state investments have failed to keep pace with increasing needs and much of the infrastructure has fallen into disrepair, forcing cities all across the country to look for new solutions to deal with this new set of problems.[121] Governments are at a critical decision point; repairing and rebuilding can be extremely expensive, making them hesitant to take on such financial burdens. The cost of removal is typically much lower than the cost of rebuilding, thus becoming an attractive option for governments from an economic standpoint.

Both ISTEA and TEA-21 started a trend where highway grants have become increasingly flexible, where local governments and planning organizations have gained more influence over how they are used.[122] The new program structure created through ISTEA and TEA-21 has encouraged a wide distribution of resources rather than their concentration on a few major

[119] Kraft-Klehm, "21 Century," 218
[120] Bigelow, "Future of Neighborhoods."
[121] Altshuler, et al., "Mega-projects."
[122] Kraft-Klehm, "21 Century," 218

projects.[123] However, while these directives do provide more flexibility, they have not significantly changed the federal government's commitment to the interstate system and its construction. Highways remain a drain on funding resources due to their costly maintenance and short life-cycle. Today, a majority of transportation funds allocated under the ISTEA regime are used by state governments and state DOTs to repair and maintain highways and bridges, sometimes even building new ones.[124] Showing that state governments are not focused on non-traffic-oriented benefits freeways removal bring. Their primary concerns are traffic flows and road safety, whereas local governments are increasingly more concerned with improving quality of life. Like ISTEA, the TIGER grant demonstrates a step in the right direction. It has the ability to deliver money to projects quickly, but it is not typically awarded for the use of conducting studies on alternatives to existing freeways, putting tremendous pressure on cities to dedicate their own resources to develop a plan that may or may not be achievable without the grant funds.[125]

From the late 1940s and through the early 1960s, elite consensus regarding highway investments was solid. Controversies that did occur were mainly fiscal and at higher levels of government. Unity and influence of supporters enabled highway officials to prevail in nearly all cases when challenged. The public investments that have most profoundly shaped urban places in the past half century have occurred within the frames of federal and state programs. Local interests have routinely been active members of the support coalitions for these programs, and then played central roles in advancing specific projects.[126] While federal highway programs, in particular, are now authorized in the context of much broader surface transportation legislation, the challenge

[123] Altshuler, et al., "Mega-projects."
[124] Kraft-Klehm, "21 Century," 230
[125] *Ibid.*
[126] Altshuler, et al., "Mega-projects."

now is a need for continual adjustment to minimize conflict among constituencies and provide substantial funding for their respective priorities.[127]

In reviewing the last fifty years, it appears that the federal government's role in surface transportation planning in urban areas was more detrimental than it was helpful. Things may have turned out quite differently had state and local governments been left to make their own decisions with their own money. Now an opportunity exists to not only acknowledge and correct past mistakes made by the federal government, but to also take charge in transforming out cities by aligning priorities in the interest of prosperity.

According to Ardilla and Salvucci in "Planning Large Transportation Projects: Six-Stage Model", for projects to be politically feasible, two conditions must be met: first, the project has to create significant benefits for a large number of constituents, and at the same time the project cannot cause harm – sometimes even slightly – to any group. Second, projects with significant opposition are not feasible anymore. Because freeway removal projects are public, they require broad consensus and an integration of planning and politics in order to garner momentum.[128] Unlike the 1960s, contested transportation issues such as freeway removal are now worked out primarily by state, regional and local levels – a result of federal legislation from the 1960s that required regional transportation planning. But politics and money remain significant forces in shaping planning decisions and transportation outcomes.[129] Currently, urban freeway removal lacks a solid foundation in our national transportation policy. Right now, state departments of transportation and regional transportation authorities are the decision-makers, putting cities with

[127] Altshuler, et al., "Mega-projects."
[128] Ardila, Arturo, and Fred Salvucci. "Planning Large Transportation Projects: Six-Stage Model." Transportation Research Record: Journal of the Transportation Research Board 1777 (2001): 116-22.
[129] Mohl, "The Expressway Teardown," 97

political and public support for freeway removal at the mercy of higher authorities that do not deal with the negative consequences of urban freeways.[130]

During construction of the interstate system, highway engineers maintained that highway construction required the demolition in order to create a transportation network that was more efficient. However, their stance ultimately crumbled under significant political pressures. While parties who oppose or support a project will resort to technical arguments to fuel their attacks, it is clear from the past highway era, this should not be the only influence over or the determining factor of a project. However, without a large commitment and effort from the champions and planners, combining both the technical and political skills, the required political support for the project will never be achieved. Many projects never get implemented precisely because planners and promoters do not do the political part of their job. Although planners do not have to be directly in politics, it is true they have to find ways of influencing decision makers.

4.3.2 Competing Interest Groups

A major hurdle for cities contemplating freeway removal is overcoming the entrenched pro-freeway stance generally held by suburban commuters, the construction industry, and state government and transportation officials who ultimately control the funds.[131] Right now, the standard approach when developing alternatives requires a "no build" option to be considered together with build-rehabilitate options. But there is no required "tear-down" option, missing the opportunity to better reflect on and review all options to better understand the opportunity costs associated with using urban land for infrastructure versus, among others, real estate development and open space.[132] The constituencies that value "automobility" generally accept the need to

[130] Kraft-Klehm, "21 Century," 231
[131] *Ibid.*
[132] Napolitan, et al., "Shifting Urban Priorities", 74

replace aging elevated freeways, but they also want to rebuild, deck or tunnel new and even bigger freeways in order to serve growing metro areas and meet projected traffic demands. Proponents of "automobility", it seems, have mostly prevailed in the recent localized battles over cars and highways. Realistically, no one *expects* that main-line expressways that carry heavy auto and truck traffic through metropolitan areas will get torn down. Teardown advocates contend that the elimination of disruptive, functionally obsolete, elevated expressways, will help restore and revitalize cities. Transportation politics and policy have turned city streets and neighborhoods into contested spaces once again. Vehicular mobility remains a divisive issue. [133]

4.3.3 Traffic Uncertainties

It has been widely discussed that increases in highway capacity is like to *induce* additional traffic.[134] Induced demand represents basic economics; adding additional travel capacity reduces time traveled costs. In the short run, demand goes up in the form of people "entering into" the travel market by shifting from other routes, modes, and times of day or both. However, in the long-term, new demand emerges; thus, "if you build it, they will come."[135] The concept suggests that building more roads actually has the effect of generating more traffic, meaning many new roads become congested shortly after they're constructed.[136] Recently though critics have begun to wonder about the reverse of induced demand. If increases in road capacity were likely to induce additional travel, would *removing* roads or reducing capacity lead to a reduction in traffic volume?

One of the main concerns around freeway removal is the resulting reduction in road capacity. Reducing road capacity in any situation, especially on highways that experience high

[133] Mohl, "The Expressway Teardown," 98
[134] Cairns et al, "Traffic Impact"
[135] Napolitan, et al., "Shifting Urban Priorities", 74- 75
[136] Cairns et al, "Traffic Impact"

volume/capacity ratios often raises public relations, political and practical considerations in which technical feasibility is the key issue. But case studies suggest there may be opportunities for reallocating or reducing road capacity, and bringing about the array of benefits already highlighted, without causing much change in travel patterns or traffic levels.[137] Greater attention is even being focused on reducing road capacity as a means of decreasing the amount of traffic.[138] However, limited empirical data exists to show what happens to the traffic displaced by a capacity reduction or road removal. This makes it difficult for cities to predict what will happen if they proceed with freeway removal projects, leaving little hope for the necessary political and public support.[139]

To understand what happened to the traffic in cases where road capacity was reduced, Goodwin, Hass-Klau, and Cairns collected evidence in their study *Evidence on the Effects of Road Capacity Reduction on Traffic Levels* from situations where capacity allocation changed as a result of such things like the implementation of bus lanes, pedestrianization, maintenance or structural repairs, even natural disasters such as earthquakes.[140] Overall, the sample of case studies for which traffic information was provided showed an average reduction in traffic on the treated road or area of about 41 percent. However, since this research only focused on changes to traffic *after* capacity was reduced, Jason Billings sought to understand the changes as they related to the *before* situation in his study *The Impacts of Road Capacity Reduction*. Billings found that with freeways in place, traffic distribution tended to be distorted, demonstrated by high volume-capacity (V/C) ratios on the urban freeways and low V/C ratios on urban street network. Overall, the results show that when

[137] Cairns et al, "Traffic Impact"
[138] *Ibid.*
[139] Billings et al., "Changes in Travel," 166
[140] Cairns et al, "Traffic Impact"

urban freeways were removed from a network, traffic flow remained unchanged because traffic redistributes throughout the surrounding network.[141]

Additionally, there are cases where capacity has been reallocated with little or no resulting reduction in traffic without making congestion substantially worse, demonstrating the ability to remove a road without causing much change in traffic or travel patterns.[142] When the Loma Prieta earthquake damaged the Central Freeway and forced its closure, local activists and even politicians wanted to explore options that did not include rebuilding the freeway. But state traffic planners warned that morning commutes would increase as much as two hours in the absence of the freeway. However, when a segment was closed for four months for demolition, none of the predicted nightmarish scenarios materialized; strengthening the argument for removal advocates.[143] Why might this have been the case?

Traffic redistribution is useful in helping to make the street network more efficient by spreading out traffic throughout the network rather than concentrating it on select roads.[144] In *Traffic Impact of Highway Capacity Reductions: Assessment of Evidence*, the authors found that in most cases traffic chaos was predicted, yet this hardly ever was the case. While some cases did have initial short-term disturbances as drivers adjusted their behavior to the new situation, they found no instances of long-term gridlock. This is because when a driver's route is closed, they will first choose the easiest option which is to use their car on neighboring streets or change their time of travel to avoid the most congested time. In the cases examined traffic redistributes in all, but in varying ways. For example, in the case of the Embarcadero Freeway removal in San Francisco, before the removal traffic was very concentrated on the freeway, while the neighboring street

[141] Billings, "The Impacts"
[142] Cairns et al, "Traffic Impact"
[143] Cervero, "Freeway Deconstruction."
[144] Billings, "The Impacts"

network was experiencing low V/C ratios. But after the freeway was removed, the distribution of the traffic throughout the area became more balanced overall. The concentration of traffic on the replacement boulevard decreased significantly, whereas the concentration on many of the other streets increased slightly, suggesting that the removal of the freeway was the primary driving force behind the redistribution. Users were able to utilize existing excess capacity to replace some of the lost freeway capacity. The removal of the freeway eliminated the high V/C ratio peaks and seemingly improved the performance from a system perspective.[145]

In the case of the Central Freeway, the other freeway removal project in San Francisco, very high traffic concentrations were experienced on the freeway with the local streets in the area experiencing really low concentrations. However, when the freeway was removed the results varied from the Embarcadero in that the traffic distribution did not change. In fact, it remained essentially the same, with the replacement boulevard experiencing a very high concentration and the local streets still having excess capacity.[146] It is important to note that the situation did not worsen with capacity reduction though. What is most interesting about the Central Freeway case is that during the time when the freeway and boulevard were both unavailable for use, the distribution of traffic actually appeared the most balanced. There were no significantly high peaks observed like in the before and after distributions, suggesting that not just freeways, but roads that operate similarly to freeways can also create an unbalanced network.[147]

What Goodwin, Hass-Klau, and Cairns' study was able to determine was that a real reduction in capacity on the treated route or area does not cause havoc because there is still adequate spare capacity on alternative routes, or at other times of day. In these situations, traffic

[145] Billings et al., "Changes in Travel," 177
[146] *Ibid.*
[147] *Ibid.*

does decrease in the place or at the time when it would experience (and cause) an unacceptable level of congestion, but it reappears on some other road or at some other time, as people change the route they take or adjust their journey time. This causes congestion to spread out over time and space, but the overall number or pattern of trips, and vehicle mileage, are less affected.

If a forecast suggests prolonged congestion of greater intensity than the current traffic conditions in the area, it is likely to have underestimated the scale of behavioral response.[148] In *Traffic Impact of Highway Capacity Reductions: Assessment of the Evidence* researchers found that a lack of congestion was likely to represent a combination of people forsaking discretionary trips or even opting for other travel modes like transit riding, walking, or cycling.[149] A group of cases representing substantial importance were the situations where capacity was significantly reduced, and there was not adequate spare capacity on alternative routes or at acceptable other times due to the nature of the network, the traffic chaos still did not ensue. In these situations, traffic counts and surveys suggest on balance that – as well as rerouting and retiming – a proportion of traffic does 'disappear' due to a very extensive set of behavioral responses. These include, but are not confined to choice of mode, destination, and trip frequency. These responses differ from individual to individual, and from place to place.[150] The way in which people respond to capacity reduction, and the types of changes they make will be determined by: the nature of the network and existing levels of congestion, the type of trip affected, the relative attractiveness of alternative locations**,** other factors influencing car use like parking controls**,** the real or perceived attractiveness and availability of other modes, the specific design details of the new road and surroundings and information and marketing.[151] Overall, Goodwin, Hass-Klau, and Cairns

[148] Cairns et al, "Traffic Impact"
[149] Cervero, "Freeway Deconstruction."
[150] Cairns et al, "Traffic Impact"
[151] Cairns et al, "Traffic Impact"

concluded that based on their found evidence some traffic does "disappear" in response to reductions in road capacity, but only to the extent that it needs to. Occurring due to responses by a proportion of drivers who take action to avoid what they consider to be, in relation to their prevailing experience, unacceptable conditions.

Significant research exists in some cases regarding points of interest such as land value, housing prices, and job creation in relation to road removal. But when it comes to understanding what happened to the traffic in the area, the research is limited to the change in traffic solely on the replacement roads. Results from the Cairns, Hass-Klau and Goodwin report *Traffic Impact of Highway Capacity Reductions: Assessment of Evidence* found that effects varied widely and depended upon the context of removal. While the study did help to explain why traffic disappears when road capacity is removed from a network, it did not explain *how* the distribution throughout the network changes. Billings points to the lingering questions surrounding the effects; are the local streets adjacent to the freeway now suffering from severe congestion? Did the congestion experienced on the freeway simply shift to another road thereby just moving the congestion to a different location? Billings research seeks to answer these questions in order to better understand the effects on traffic in the surrounding area after removing road capacity.[152] While his study provides a good baseline for what cities can expect to happen to the traffic distribution in the area around a capacity removal project, adding more cities to the case study list is the key to presenting a more comprehensive picture of the effects of capacity removal on traffic redistribution.

While many freeway removal projects have limited results, they have become helpful in establishing a framework that other cities could use for their own analysis. Billings was able to determine from his study, *The Impacts of Road Capacity Removal*, that if cities are to contemplate

[152] Billings et al., "Changes in Travel," 175

freeway removal projects, understanding the manner in which aggregated traffic volumes change will be a critical component. Additionally, more case studies will need to be incorporated, with more robust data of before, during, and after conditions, to determine the precise nature of traffic redistribution effects for each road design type.[153]

Again, while it is still not fully understood the true effects of what happens when road capacity is reduced or when a freeway is removed, according to Cervero's study, it does seem to be that the biggest change in travel behavior was a shift from the freeway to other nearby roads.[154] One of the main factors cities will need to determine before embarking on a freeway removal project is whether excess capacity exists on surrounding street networks. Distorted traffic distributions appear to exist in many cities across the U.S., with high traffic concentrations on their urban freeways, yet low concentration on their local street networks. The exact nature of the redistribution is likely dependent on many factors, but it seems that removing a freeway or reducing road capacity tends to force a redistribution to occur.[155] Considering this, it seems likely cities will begin to experience a more balanced distribution if they proceed with removing segments of urban freeways because there is excess capacity to absorb some of the traffic currently being carried by the freeway.[156] Cities experiencing these conditions would be good candidates for pursuing road capacity reduction projects in some form.

Billings, Garrick, and Lownes' analysis suggests that many of the fears associated with freeway removal are unwarranted, and that while the jury is still out on the long-range impacts of freeway deconstruction, evidence to date also suggests that, on balance, they are positive, and the

[153] Billings, "The Impacts"
[154] Cervero, "Freeway Deconstruction."
[155] Billings et al., "Changes in Travel," 180
[156] Billings, "The Impacts"

overall changes seem to be beneficial for the city.[157] It would be incorrect to generally presume that any certain percentage of traffic will simply disappear when road capacity is reduced. On the other hand, it would also be wrong to assume that no traffic will disappear. While there is a lack of "perfect" case studies, to find so many cases of reductions in traffic, during a time where there is increasing car ownership and general traffic growth, shows a balance of evidence that a proportion of traffic can indeed "disappear" when capacity is reduced.[158] The general policy framework within which road capacity reduction decisions are made, the way in which the project is implemented, and various other conditions occurring within the project area at the time will also have a strong bearing on how traffic reacts and how the project will be perceived politically.[159]

Cervero concludes that evidence suggests the more valuable resource in many large, built-up cities is high-quality public space and urban amenities, not transportation accessibility.[160] But Cervero, Kang, Shively determined that while freeway-to-boulevard conversions gives more emphasis to neighborhood quality and less to accommodating the automobile, it yields net-positive benefits without seriously sacrificing transportation performance.[161] The balance of evidence is that measures which reduce road capacity, when well-designed and paired with strong policy, should not automatically be rejected for fear of "unacceptable" congestion. The impacts of a particular project will be strengthened or weakened by existing network conditions, policy, and changing environments due to a wider array choices of home, work, and social activities.[162]

[157] Cervero, "Freeway Deconstruction."
[158] Cairns et al, "Traffic Impact"
[159] *Ibid.*
[160] Cervero, "Freeway Deconstruction."
[161] Cervero et al., "From Elevated Freeways," 31
[162] Cairns et al, "Traffic Impact"

4.4 What might be possible for Seattle?

4.4.1 Background and Context

In 1953, the Washington State Legislature adopted plans for a tolled "superhighway" for the Tacoma, Seattle, and Everett region. Stalled until funds opened up with the passage of the Federal Highway Act of 1956, construction finally began in early 1963.[163] It may be hard to imagine a Seattle without the presence of I-5, and it may be even harder to believe that it has only been there for 50 years, since it appears that the city is built up *around* the highway. Before its construction, Seattle's urban fabric moved from the waterfront of Elliott Bay, up and over Capitol Hill, and down to the waterfront of Lake Washington, with challenging topography acting as the main barrier. However, that is not the Seattle known today as the construction of I-5 split the city in two, severing downtown from Capitol Hill, First Hill, and other areas to the east, isolating whole

Figure 33 Construction of I-5 east of Lake Union

Source: https://www.seattletimes.com/seattle-news/transportation/these-7-photos-reveal-how-i-5-construction-tore-through-old-seattle/

[163] Keeley, Sean. "Seattle History Lessons- The Story of I-5", Curbed Seattle. 14 October 2014, https://seattle.curbed.com/2014/10/14/10036458/curbed-seattle-history-lessons-i5-highway-downtown.

neighborhoods like Eastlake and cutting up others like the Chinatown International District. During its construction, nearly 4,500 parcels of land were cleared.[164] As previously discussed, building a highway through an active and growing city presented major challenges in almost every instance. The roads required large amounts of land and here in Seattle, swaths of buildings and neighborhoods, some dating back to the earliest pioneer settlements, were sacrificed.[165] This not only had detrimental economic and aesthetic effects, it made Seattle challenging to navigate, whether it was by foot, bike, or car. Routes over or under the freeway became difficult to find because of the below-grade sections or elevated structures I-5's construction required. It created incentive to not make the trip at all or instead, drive.

Figure 34 Construction of I-5 looking towards Beacon Hill

Source:https://www.seattletimes.com/seattle-news/transportation/these-7-photos-reveal-how-i-5-construction-tore-through-old-seattle/

On May 14, 1969, the last piece of I-5 in Washington opened to traffic, marking the moment motorists could travel from the Canadian border to the California state line without stopping.[166] By design, the highway, especially the downtown corridor, was meant to relieve congestion by moving people through the city more

[164] Diltz, Colin. "These 7 Photos Reveal How I-5 Construction Tore Through Old Seattle". *The Seattle Times.* 2 January 2016, https://www.seattletimes.com/seattle-news/transportation/these-7-photos-reveal-how-i-5-construction-tore-through-old-seattle/.
[165] Keeley, "Seattle History Lesson."
[166] *Ibid.*

quickly, and today it acts as one of the key commute and economic corridors in the Central Puget Sound region. However, while it carries more people than any other road in Washington State, it is also responsible for delaying the most people as well.[167]

It did not take long for the congestion to accumulate on Seattle's I-5 downtown corridor. Its engineering did not account for the short local trips between Seattle neighborhoods that motorists began used the highway for. Today the congestion only continues to grow. Overall, there was a 7.5-mile increase between 2014 and 2016 in locations where routine congestion occurred, with the duration of routine congestion increasing by 31.5 percent.[168] Of the 91 miles of I-5 between the cities of Federal Way and Everett, nearly 71 miles of it are routinely congested in both directions, with Seattle's downtown segment experiencing the worst routine congestion.[169]

In addition to delaying commuters, this increase in congestion directly impacts the movement of goods in Washington as trucks accounted for over 7 percent of the total daily traffic volume on the corridor in 2016.[170] According to the City of Seattle's *Freight Master Plan*, Washington State is the most trade-dependent state in the nation, with Seattle being the economic center, making freight mobility crucial to a successful local, state, and regional economy.[171] The Interstate Highway System contains the primary corridors for freight movement in Washington and I-5 is the most important north-south interstate corridor in the state.[172] However freight traffic is increasing, and can cause congestion and delays that create a ripple effect.

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[167] Gutman, David. "Here's Why I-5 is Such a Mess in Seattle Area, and What Keeps Us Moving At All", Seattle Times. 19 June 2017, https://www.seattletimes.com/seattle-news/transportation/heres-why-i-5-is-such-a-mess-in-seattle-area-and-what-keeps-us-moving-at-all/.

[168] Washington State Department of Transportation. *The 2017 Corridor Capacity Report*. 2017, accessed April 12, 2018: 13 http://wsdot.wa.gov/publications/fulltext/graynotebook/corridor-capacity-report-17.pdf.

[169] "The 2017 Corridor," 13

[170] "The 2017 Corridor," 12

[171] Seattle Department of Transportation. *City of Seattle Freight Master Plan*. 2016, accessed on May 5, 2018: 2 https://www.seattle.gov/Documents/Departments/SDOT/About/DocumentLibrary/FMP_Report_2016E.pdf.

[172] "2017 Washington State," 19

The American Transportation Research Institute (ATRI) has been collecting and analyzing truck GPS data for the Federal Highway Administration since 2012. The institute monitors and assesses freight-significant locations throughout the country to find truck bottlenecks and quantify their impacts. ATRI's 2017 top 100 truck bottleneck list found nine truck bottlenecks in

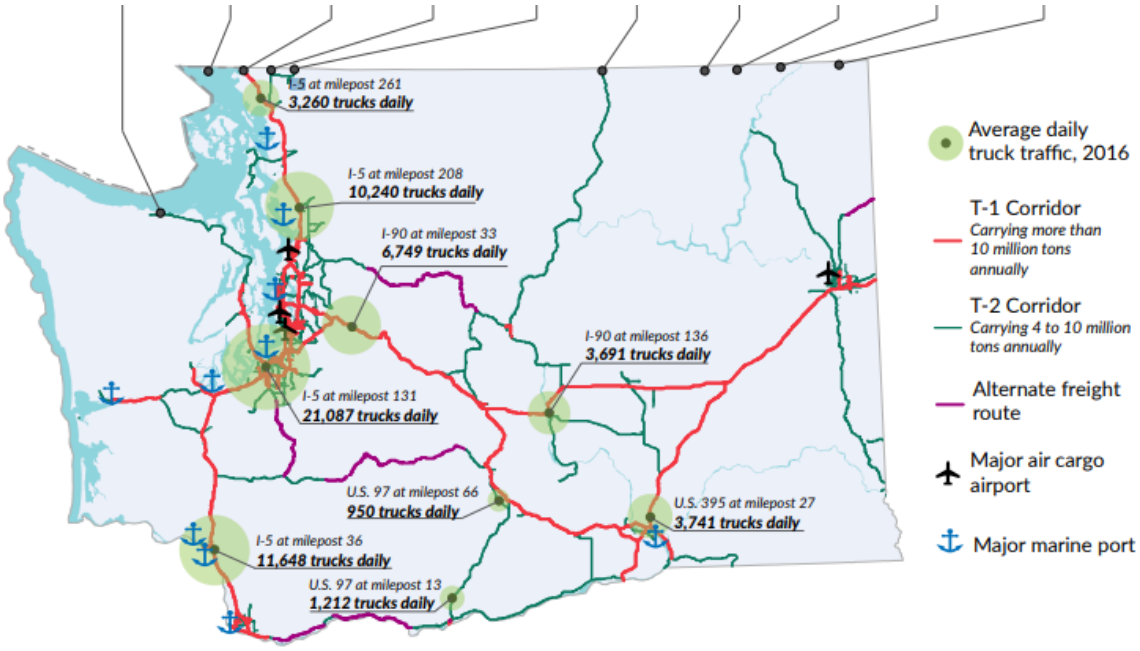

Figure 35 WA State Freight Corridors

Source: Washington State Department of Transportation

Washington, two of which are in Central Puget Sound and are among the top ten worst truck bottlenecks: SR 18 at SR 167 and I-5 at I-90.[173]

When bottlenecks occur on Truck Freight Economic Corridors, they result in highway and road congestion that delay the movement of freight. Further, population growth in the state, especially in crowded urban centers, produces more freight and general purpose trips, generating more congestion.[174] This compromises the reliability of the highway system that is critical for retailers and manufacturers who are now shipping smaller amounts of freight at more frequent

[173] "2017 Washington State," 77
[174] *Ibid.*

intervals to stores and factories.[175] With short delivery windows, this will increase the pressure for trucks to be on time, creating a need for a much more reliable truck freight corridor in congested urban areas. Thinking from a broader system perspective, congestion not only affects highway mobility, it also affects freight movement on other modes. Goods moving from one area of the state to the airport of seaport could get stuck in traffic and miss an international flight or cargo ship.[176] Overtime, as conditions worsen with growth, this could begin to detrimentally affect economies. WSDOT conducted a study on the impacts of truck congestion on the state economy and projected that a 20 percent increase in congestion would cause over 21,700 job losses, as well as decreased regional output of over $3.6 billion in the central Puget Sound region alone.[177]

According to Seattle's *Freight Master Plan* – in 2011 68.5% of freight tonnage and 80.7% of freight-related revenue in Washington was transported by truck.[178] Overall, according to WSDOT, it will monitor changes to global supply chains as they expect demand to grow on major truck and rail routes as manufacturing increases in North America. As more time-sensitive freight services are needed to move goods manufactured domestically, especially in urban areas, traffic on major north-south routes is expected to grow, increasing the importance of the I-5 corridor.[179]

With so much of the Seattle economy reliant upon truck movements, the roadway infrastructure is critical. WSDOT says the Truck Freight Economic Corridors in Washington lack enough highway capacity to handle population and business growth.[180] As delivery travel patterns are shifting, it will be important to evaluate the freight networks in Washington, especially in urban areas. Knowing there is a larger demand for shorter and more local trips, Seattle will need to

[175] "2017 Washington State," 74
[176] *Ibid.*
[177] *Ibid.*
[178] "City of Seattle," 34
[179] "2017 Washington State," 88
[180] *Ibid.*

optimize its freight network to increase reliability as the more localized deliveries increase. As it exists today with its routine congestion, I-5 through Seattle, especially downtown, is not a reliable piece of the freight network for the city.

While the highway's level of congestion could cost the state and region billions of dollars, finding the money to maintain the structure is a daunting task. As the federal gas tax, that helps pay for the interstate system, dwindles due to a growing number of people driving more fuel efficient or electric cars, or opting not to drive at all, the money coming in is simply not enough to address the delayed repairs, future repairs, and expansion projects WSDOT has accumulated over the years.[181] With the concrete being over 50 years old, former WSDOT secretary Douglas MacDonald asserts that pavement distress is one of the main issues, with the worst stretch existing between Tukwila and Snohomish County, incorporating the corridor through downtown Seattle.[182] Nearly 30 percent of the state's total transportation budget, passed in 2017, will be tied up in the maintenance and up-grades to I-5 over the next 15 years.[183] Further, a draft report produced by the Puget Sound Regional Council in the Vision 2040 plan detailed the work I-5 will require between now and 2040, comprising 18 percent of the total statewide preservation needs. The report shows that preserving pavement alone will cost $1.2 billion and bridge, drainage, and electrical repair will cost another $1.3 billion.[184] These estimates are simply to maintain the existing system.

Another threat I-5's presence presents, especially when looking at the Seattle downtown corridor, is the pollution it generates on a daily basis due to the routine congestion. According to

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[181] Puget Sound Regional Council. *The Regional Transportation Plan*. 2018, accessed May 14, 2018: 25 https://indd.adobe.com/view/1af394e0-4e37-4982-9155-a2ee1e221b75

[182] MacDonald, "Trans-poor-tation."

[183] Washington State Department of Transportation. *2017 Supplemental Budget for 2015-2017 and 2017-2019 Enacted Budget*. 2017, accessed April 12, 2018, https://www.wsdot.wa.gov/sites/default/files/2018/01/12/Budget-Enacted2017-19-BudgetBook_0.pdf

[184] "The Regional Transportation," 44

the WA State Department of Ecology, transportation-related activities contributed 46.2% of all greenhouse gases released into the atmosphere in 2012 (most recent data available).[185] Transportation as a percent of statewide emissions is higher compared to the national average of 27%.[186] The L.A. Times recently ran an article about the increasing amount of housing being built near freeways in L.A. specifically, but it is happening in urban areas all over the U.S. In the article, Rob McConnell, a professor of preventative medicine at USC who studies roadway pollution has been warning city officials about the consequences of building housing near freeways. In fact, California air quality officials have been recommending that housing be located more than 500 feet away from freeways for more than a decade now, as research shows people living near freeways suffer higher rates of asthma, heart attacks, strokes, hung cancer, and pre-term births.[187] The article further reports that California state environmental officials concluded that diesel soot and other harmful carcinogens produced by vehicle exhaust poses nearly three times the cancer risk previously thought. Additionally, researchers have recently found that traffic pollution can drift more than a mile away from traffic. Solutions to these issues have largely only dealt with how to *manage* the spread of traffic pollution, by reducing tailpipe emissions and through a hopeful transition to cleaner vehicles and fuels. But, as the article also points out, health officials believe the only way to solve the problem is through a halt on residential building near freeways.[188] However, this poses a problem because for many cities; especially in L.A. where freeways crisscross the city, and for Seattle where I-5 runs north-south through a geographically narrow city center. Further, as urban areas increase in density, it becomes important to concentrate housing

[185] "The 2017 Corridor," 9
[186] "The 2017 Corridor," 9
[187] Barboza, Tony, and Jon Schleuss. "L.A. Keeps Building near Freeways, Even Though Living There Makes People Sick." Los Angeles Times. March 2, 2017. Accessed February 26, 2018. http://www.latimes.com/projects/la-me-freeway-pollution/.
[188] Barboza et al., "L.A. Keeps Building"

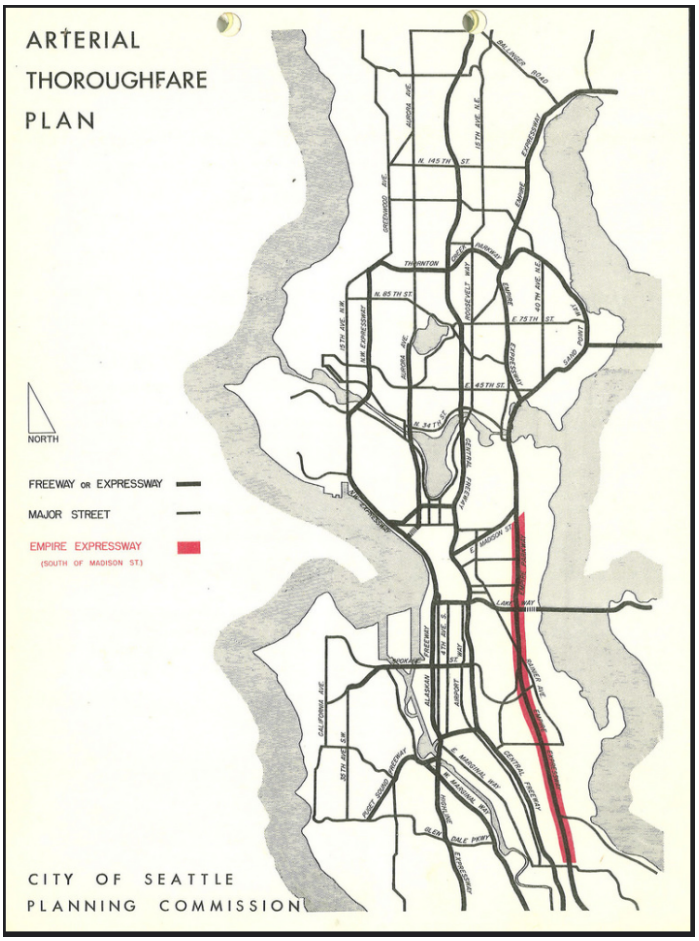

Figure 36 1957 proposed freeway plan for Seattle (mostly cancelled)

Source: Seattle Municipal Archives

near transportation corridors for mobility purposes. Simply not placing housing near freeways would put a limit to the amount of housing that could be built in the city, and with many cities facing a housing crisis, like L.A. and Seattle, this is not a sustainable option.

Seattle's I-5 corridor disrupts the urban fabric, concentrates congestion that causes delays for commuters and freight, and spreads pollution. Considering these problems and the funding necessary to repair, up-grade, and maintain the highway, at this point in time it does not appear to be feasible or practical to retrofit or rebuild I-5's downtown Seattle corridor as it stands today.

4.4.2 Argument for Removal

Shortly after the opening of I-5 in 1969, King County voters rejected the regional transit package *Forward Thrust*. The package consisted of a robust rapid transit system that would have created 500 miles of bus routes and 49 miles of rail.[189] However, at that point in time, King County's population was mostly living in low-density environments and moving around by car.[190]

[189] Walt Crowley, Routes: An Interpretive History of Public Transportation in Metropolitan Seattle (Seattle: Metro Transit, 1993), 54-55.
[190] *Ibid.*

Additionally, plans for more freeways (largely cancelled) were being explored at the time. Seattle, like many other U.S. cities sacrificed other forms of transportation in favor of the car, over accommodating it and limiting the number of mobility options available to people throughout the city. Alone, cars and the infrastructure they require are not the problem, as they have proven to be an important element in the nation's transportation system. However, they must to be one of many elements.[191] Freeway removal advocates believe a greater investment in mass transit and light rail should be the future of transportation in the United States because congestion on highways in cities remains a constant struggle. In looking at past American transportation policy, transit has never been prioritized. Local operations fell on hard times during the 1920s and 1930s due to poor management, bad service, and declining profits. With the increasing popularity of the personal automobile and after federal investment in highways, transit in American cities lost all traction it once had.[192] However, the recent trend of highway removal seems to have ignited interest in American cities for new investment in rail transit. Some cities have used former highway corridors for new transit lines, and many freeway removal advocates seek new investment in public transportation, especially streetcar lines and light rail.[193]

On November 8, 2016, voters in the Central Puget Sound region approved the Sound Transit 3 (ST3) ballot measure. The plan expands 62 miles of light rail, bringing the total system to 116 miles servicing over 80 stations. It will expand north to Everett, south to Federal Way and Tacoma, east to downtown Redmond, south Kirkland, and Issaquah, and west to Ballard and West Seattle. But ST3 is not only a light rail package, it expands Bus Rapid Transit (BRT) and Sounder

[191] Norquist "Wealth of Cities."
[192] Norquist "Wealth of Cities."
[193] Mohl, "The Expressway Teardown," 91

commuter rail regionally as well.[194] When finished, the system will connect 16 cities via light rail, 30 cities with BRT, and 12 cities with commuter rail across King, Pierce, and Snohomish counties. Under ST3, 600,000 riders a day are expected to use light rail, providing service 20 hours a day, every six minutes during peak hours and every ten minutes in non-peak hours. The Sounder commuter rail is expected to carry 40 percent more passengers with the potential to run more trains daily.[195]

Further, transit ridership has seen major increases during the last ten years, a 41.8 percent increase and a 4.8 percent increase in the last year.[196] Since 2016, Sound Transit has added three additional light rail stations, leading to a 91 percent jump in ridership from 2015.[197] In addition to

[194] Sound Transit. *Sound Transit 3: The Regional Transit System Plan for Central Puget Sound*. 2016, accessed April 12, 2018: 1 https://www.soundtransit.org/sites/default/files/project-documents/st3-system-plan-2016.pdf.
[195] "Overview." Sound Transit 3. Accessed April 12, 2018. http://soundtransit3.org/overview.
[196] Seattle Department of Transportation. *2017 Traffic Report*. 2017, accessed April 12, 2018: 5 https://www.seattle.gov/Documents/Departments/SDOT/About/DocumentLibrary/Reports/2017_Traffic_Report.pdf
[197] Commute Seattle. *2017 Center City Commuter Mode Split Survey Results*. 2017, accessed April 12, 2019, https://commuteseattle.com/wp-content/uploads/2018/02/2017-Commuter-Mode-Split-Survey-Report.pdf.

this, survey results from Commute Seattle, a local non-profit that partners with the Seattle Department of Transportation (SDOT), found that nearly half of downtown commuters have turned to transit for their daily commute.[198] Seattle has invested heavily in bus service as well as rail expansions in recent years, representing a shift among Seattle residents and voters. In 2014, King County Metro was facing potential bus cuts because of budgetary constraints, but Seattle voters added a $60 vehicle registration fee and increased sales tax by 0.1 percent. Those funds then went towards the improvement of service and increased frequency. The rewards from these mass transit investments has manifested itself in data that demonstrates transit commuting growth, especially among downtown workers.[199]

Figure 37 Sound Transit 3 Project Map

Source: Sound Transit

[198] "2017 Center City," 7

[199] Schmitt, Angie. "Seattle Adds People Without Adding Traffic." Streetsblog USA. 18 December 2017, https://usa.streetsblog.org/2017/12/18/seattle-adds-people-without-adding-traffic/

Data shows that even with conservative assumptions, transit ridership along the I-5 corridor translates to a capacity savings equivalent to more than 4.5 additional lanes of traffic during peak commute periods.[200] WSDOT points out that transit ridership means fewer cars on the road, which helps *manage* traffic congestion by making the most efficient use of available highway capacity, improves mobility and accessibility, and reduces greenhouse gas emissions. Without transit, congestion and subsequent delays would have been worse.[201] The passage of ST3 and the $60 vehicle registration fee and sales tax increase to help save Metro service represents a major commitment and shift in the attitudes toward mass transit in the Central Puget Sound region by voters and officials. It demonstrates a commitment to mass transit, locally and regionally suggesting that it is time to reexamine infrastructure investments, especially the role of I-5 as it continues to delay the movement of people and goods. While transit may help keep congestion levels from growing, transit expansion will do little to *reduce* traffic on I-5.

4.4.3 Vision for Seattle

Accommodating cars generates effects that increase the need for further accommodation, in a never-ending cycle that will always require more space many cities simply do not have. In an urban environment where an urban freeway moves through the city center, freeway users will eventually need or want to exit into the downtown. Exit ramps dump onto city streets that must be widened in order to bear the increased load, essentially turning them into ramp extensions.[202] Once downtown, vehicles require parking so large surface lots and garages have been built to address a demand that will never be satisfied. [203] Now cities are in a position where valuable and, often

[200] "The 2017 Corridor," 3
[201] "The 2017 Corridor," 12
[202] Norquist "Wealth of Cities."
[203] *Ibid.*

times, scarce urban land is consumed for the sole purpose of moving and storing cars. Urban residents often live closer to work, school, shops, recreation, and other necessities, thus traveling by car far less than suburban residents. However urban residents disproportionately suffer the consequences of automobile-dependent life.[204] In light of the growing threats pollution presents to urban residents, the need for more urban housing, the increased congestion and delays urban freeways induce, cities must begin to figure out how to create environments that are not only "livable" in the sense that they are attractive and offer an array of options for transportation, housing, and amenities, but that they are also *acceptable* environments for human life.

The Seattle I-5 downtown corridor has hardly served its purpose efficiently, from its infancy the highway became congested because the context within which it was placed was largely ignored. Engineers intended to move traffic quickly between and through the city, but the highway immediately began to generate and concentrate congestion on the downtown corridor. The amount of local traffic that began to use the freeway for short trips between neighborhoods within the city required cars to cross multiple lanes of traffic quickly to make an exit, interrupting traffic flows.[205] This congestion only continues to grow today as the economy and population expand. While the congestion is problematic for the movement of people and goods, creating unreliable travel times that have fiscal consequences for both individuals and companies, the pollution it generates as traffic stalls on the highways is actively harming nearby residents. Considering that the highway is routinely congested throughout the day, generating and spreading pollution into our downtown, is it worth its detriments? Additionally, the money to perform the backlog of maintenance WSDOT has delayed for years and the money necessary to continue maintaining I-5 is not only financially

[204] *Ibid.*
[205] *Ibid.*

crippling, but it is nonexistent at this point. With residents within the Central Puget Sound region demonstrating a commitment to expanding transit and improving mobility, it may be time we reexamine our infrastructure investment priorities and seek ways to *remove* traffic from I-5, section by section.

What might Seattle look like if a portion of I-5's downtown corridor was removed and the space repurposed? For starters, east-west connections would vastly improve, restoring the original grid Seattle once had, allowing for consistent movement from Elliott Bay to Lake Washington. Removing the I-5 barrier and establishing more flow east-west would allow for the improved movement of all modes of transport; walking, cycling, driving and transit. More paths would become available and the need to find the limited ways over or under the highway would be eliminated.

Figure 38 Opportunity for improved east-west connections in Seattle

Source: Patano Studio Architecture (arrows added by author)

The improved east-west connections would facilitate the reknitting of the urban fabric that was destroyed in the construction of I-5. Capitol Hill would no longer feel like a separate entity, but perhaps a part of downtown. The Chinatown International District would no longer be split in two

allowing for more consistent development to occur, and a more cohesive cultural district. Downtown stands to have the biggest transformation. The path of I-5 is large, if it were removed it could open up space for all kinds of development, especially much-needed affordable residential development as it would be located near transit, services, and other amenities.

If the highway through downtown were to be replaced by an at-grade boulevard, the reduction in capacity would help reduce the amount of pollution spreading into downtown by directly pulling cars off the road. This could also help traffic redistribute more evenly throughout the overall network. The road could also become multi-modal, allowing for cars, transit, pedestrians, and bikes to all utilize the same space, whereas right now I-5 only allows for the movement of trucks, busses and cars. A multi-modal boulevard could create a vibrant pedestrian

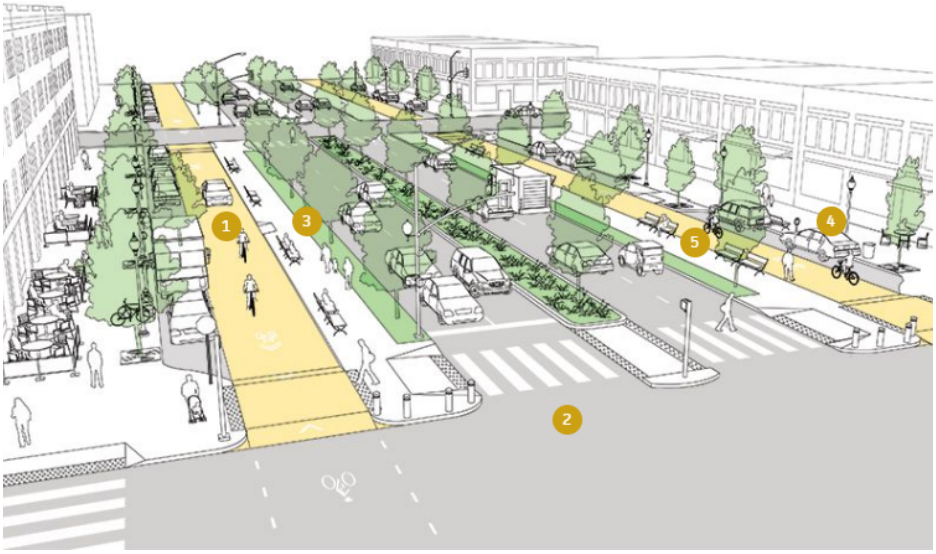

Figure 39 Multi-modal boulevard example

Source: Urban Street Design Guide: https://nacto.org/publication/urban-street-design-guide/streets/boulevard/

Figure 40 Seattle Waterfront Project

Source: James Corner Field Operations

realm and green space that downtown Seattle sorely lacks as of today. With the Seattle Waterfront Project beginning to come online in 2019, residents of Seattle will soon have practical evidence of how a freeway removal project can transform a city. Removing a portion of I-5 and repurposing the space it occupies could create an additional pedestrian realm through the heart of the downtown that could help foster a robust green space network in the city.

4.4.4 Major Hurdles for Seattle

However, while it may seem like a clear choice imagining all of the potential benefits, achieving them would be quite challenging for the city of Seattle, as many barriers to the process exist. Interstate 5 was built by the federal government and is owned by the State of Washington. Jurisdictions with varying priorities stand as a major barrier for an I-5 removal project. I-5 is the lifeline of the Puget Sound Region, with Seattle's at its center.[206] Even if the city of Seattle campaigned to remove a portion of the highway through downtown, the decision-makers are state officials. While plans put forth by the city would likely be examined, as they were in the recent State Route 99 project, further discussed in the coming sections, the plan will be stacked against other priorities that cater to the larger needs of the state and region, as transport infrastructure is

[206] Keeley, "Seattle History Lesson."

essential to being competitive in an urban or regional economy.[207] More locally, thousands of Washington's residents use I-5 to commute to work, and their ability to get to work is essential to maintaining a regional economic competitiveness.[208] The downtown corridor alone saw an annual average daily trips of 207,000 in 2017.[209]

While Seattle voters may have demonstrated a commitment to expanding local and regional transit, they have also demonstrated a major commitment to the preservation of highway capacity within the city. State Route 99, also known as the Alaskan Way viaduct in Seattle became a very contentious topic in the city in 2001 when it was heavily damaged in the Nisqually earthquake. Many interest groups came forward in the interest of using this unique opportunity to reimagine the highway or more so, the city, without the presence of the viaduct. Citizens were interested in exploring the option of removing the viaduct and building a tunnel replacement or removal with no replacement at all. State and city transportation officials favored the tunnel option

Figure 41 SR-99 (yellow) and I-5 (red) through downtown Seattle

Source: Google Earth

[207] Cervero, Robert. "Transport Infrastructure and Global Competitiveness: Balancing Mobility and Livability." The Annals of the American Academy of Political and Social Science 626, no. 1 (2009): 210-25.
[208] MacDonald, "Trans-poor-tation"
[209] Washington State Department of Transportation. *Peak Hour Report*. 2017, accessed April 12, 2018: 17 http://www.wsdot.wa.gov/mapsdata/travel/pdf/2017-peak-hour-report.pdf.

Figure 43 SR-99 (Alaskan Way viaduct) in Seattle, WA

Source: http://mynorthwest.com/991384/it-will-cost-93m-to-demolish-the-alaskan-way-viaduct/?

Figure 42 "Bertha", the largest tunnel boring machine in the world used to dig the SR-99 tunnel

Source: Washington Department of Transportation

but evaluated five different options finally deciding the tunnel was the way to move forward. The multibillion dollar cost of digging a tunnel had many people hesitate to press forward with the project, so local media in Seattle continued to entertain scenarios in which the road would not be replaced. In these scenarios, the Alaskan Way surface street and other roads would be improved and transit within the city expanded to deal with the traffic accommodations, as the viaduct funneled around 110,000 vehicles a day. Advocates of this option imagined a new vibrant civic space that accommodated multi-modal transit and reconnected the city to its waterfront, prioritizing these aspects over the

movement of vehicular traffic. The governor at the time ultimately rejected the tunnel project over major safety concerns, causing state and city officials to become deadlocked on how to move forward. With support of the city council, the state called for an advisory ballot for Seattle residents to vote on whether they supported the tunnel option or a rebuild of the elevated structure, but residents rejected both options in 2007. Finally, in 2011, voters were asked again to vote on the tunnel option and approved the measure with 60% in favor, demonstrating Seattleites commitment to vehicular mobility. The no-replacement option would never be explored further.

Another barrier to proposing a removal option for I-5's downtown corridor is the widely discussed Lid I-5 campaign. Cities all over the U.S. are looking to improve their downtowns as populations in urban centers increase, with one such method being the creation of lids (also known as decks or caps) over highways that cut through the center city. These projects are embarked upon in the interest of creating new land for green space or other development the city

Figure 44 Conceptual lid proposal for I-5

.Source: Patano Studio Architecture

may be seeking. The creation of space above a freeway can help reconnect neighborhoods once divided by freeway construction.[210] Here in Seattle, people have grown used to the presence of I-5, but efforts to at least reduce its impacts and connect the city continue to surface, particularly in the form of lids.[211]

The Lid I-5 Campaign has garnered a lot of attention in recent months, launching a dynamic website that clearly highlights the benefits of a Seattle freeway lid, establishes clear project goals, and even proposes funding strategies. Recently the campaign has even hosted design charrettes and received $1.5 million for a feasibility study as part of the Washington State Convention Center expansion project's community benefits package.[212] However, skeptics of lid projects argue that highways with parks on top are still highways. They believe cities would be better off investing in ways to *remove* the nuisances and harms urban freeways create, not just hide them. Being over a highway is not a pleasant environment because the noise, traffic, and pollution do not disappear with the construction of a park.[213] Martha Moore points out, in her article "More Cities are Banishing Highways Underground – And Building Parks on Top", that lid projects are very expensive. Chicago's Millennium Park, built over railroad tracks, cost $490 million and Dallas' Klyde Warren Park cost $110 million. She asserts that with these kinds of projects a city could run the risk of investing in an expensive new park, but not a great park (or space) because it has not

[210] Moore, Martha. "More Cities are Banishing Highways Underground – And Building Parks On Top", Huffington Post. 2 April 2018, https://www.huffingtonpost.com/entry/more-cities-are-banishing-highways-underground-and_us_5ac2392be4b06d87de5a54ea.
[211] Keeley, "Seattle History Lesson."
[212] Community Package Coalition. *The Community Package.* 2018, accessed on May 25, 2018, https://www.communitypackage.org/communitypackage/
[213] Moore, "More Cities."

addressed many of the problems urban freeways create.[214] Here in Seattle, Freeway Park stands as a great example. But the problem with Freeway Park is that noise and pollution are still present despite its construction. While it is exciting to see people reimagining I-5, the imagery stops short of solving many of the core issues I-5 presents. The Lid I-5 Campaign has created tunnel-vision amongst residents, limiting the options being considered repurposing of I-5.

Figure 45 Freeway Park over I-5, Seattle, WA

Source: https://crosscut.com/2016/01/a-park-over-interstate-5-not-a-new-idea

The reduction in road capacity that would result from removing a portion of I-5 through downtown Seattle would perhaps be the most challenging hurdle for Seattle to overcome. The downtown corridor carried 207,000 vehicles, on average, on a daily basis last year, making it the busiest road in the state. Fear that traffic on I-5 will increase once the SR-99 viaduct is removed, due to the implementation of tolls in the new tunnel, will only do more to increase resistance. While, from the limited research available, it does appear as though "chaos" is not likely to manifest and traffic will eventually redistribute itself in the long-term as people adjust their behavior to new circumstances, it is difficult for people to imagine how this could be possible without more concrete assurance. Further, without any freeway removal examples to examine of roads that acted

[214] Moore, "More Cities."

as major north-south regional corridors and carried the amount of traffic I-5 does, it is difficult to imagine a removal without a solid grasp on how traffic and freight movement can adapt.

4.4.5 Addressing Seattle Hurdles

Urban freeways come with high environmental costs, massive land consumption, and dysfunctional urban districts. To achieve a high quality of life and public amenities necessary in today's economy for attracting and retaining current populations, cities will need to find a balance between transportation infrastructure for economic purposes and place-making and community-building goals.[215] With a growing population and more Seattleites utilizing light rail and other forms of transit to commute to their downtown jobs, it is time to find a greater transportation balance within the city and region. With I-5 occupying valuable urban land and with traffic congestion worsening, and understanding that expanding the highway is neither fruitful in terms of congestion relief or feasible due to a lack of space, it may be time to examine bold interventions, such as freeway removal, that seek to remove cars from the road, meet many planning objectives like housing development and multi-modal transit while also confronting past planning mistakes and establishing a new paradigm for urban living.

While Seattle faces many hurdles to embarking upon removing a portion of I-5 and repurposing the space it occupies, these hurdles are not insurmountable. More Seattleites are utilizing light rail and other forms of transit to commute to their downtown jobs, and with the expansion of ST3 and growing congestion, transit will become even more competitive. The traffic chaos often predicted in the face of major road capacity reduction has largely never occurred. Additionally, while removing a section of I-5's downtown corridor would be a sacrifice in mobility for many, according to Jason Billings' *The Impacts of Road Capacity Reduction*, Billings found

[215] Cervero, "Transport Infrastructure," 210

that Seattle was one of the nine cities experiencing distorted traffic distributions, with high concentrations on urban highways and low concentrations on the local street network.[216] This could indicate there may be excess capacity available for absorption.

[216] Billings, "The Impacts"

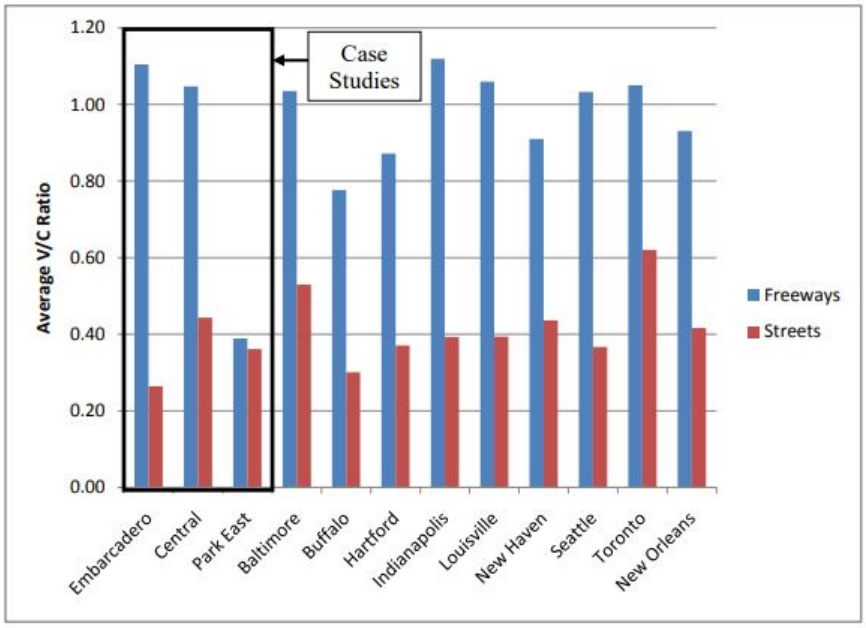

Figure 46 Average V/C Ratios for Seattle Network

Source: Jason Billings "Impacts on Road Capacity Reduction"

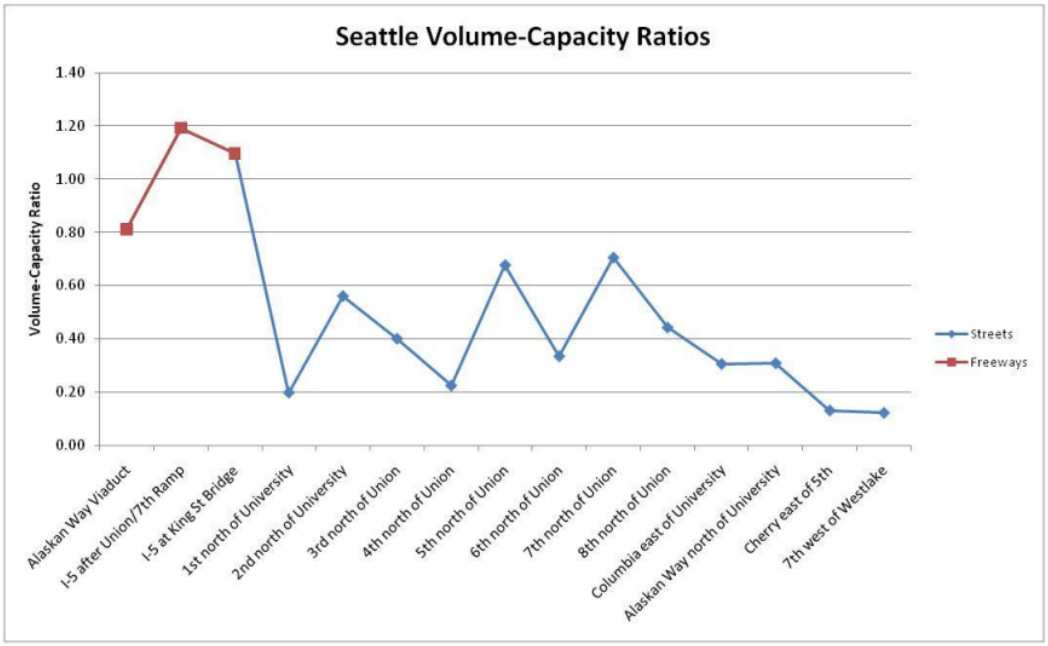

Figure 47 Seattle's Volume Capacity Ratios Source: Jason Billings "Impacts on Road Capacity Reduction"

As for the issues of fright movement, e-commerce continues to grow more rapidly across the country than overall retail growth. This trend is shifting freight distribution towards more point-to-point shipments from warehouses to homes and businesses, leading to more short trips in urban areas via parcel trucks.[217] Additionally, consumers are increasingly shopping online in lieu of visiting retail stores. As consumers shift their shopping patterns, so too do delivery travel patterns shift. Now that consumers are increasingly expecting deliveries in very small timeframes once ordered, there is a trend towards more, but smaller, distribution centers serving smaller territories, resulting in a higher proportion of short trips and fewer long-distance trips by delivery trucks.[218] In looking at the projected truck volume maps for 2035, it can be seen how volume is expected to increase on the local freight network, indicating this increase in more localized deliveries.

As congestion worsens citywide, the movement of goods will become more challenging in terms of mobility, travel time, and reliability.[219] Additionally these delays could cause trucks to seek other routes, affecting mobility in other parts of town.[220] Right now it may be very difficult politically and even feasibly to remove a portion of I-5 through downtown Seattle, as it could make freight movement more challenging during a time where congestion is at an all-time high and there is still a high demand for longer freight trips. If I-5 were replaced at the moment with an at-grade, reduced capacity boulevard, freight movement through the city would be subjected to slow-downs, especially in the short-term, and it could make for an unpleasant environment for those living, working, or visiting downtown. However, in light of shifting consumer patterns, removal could *become* possible as demand for longer trips diminishes over time. Further, the city of Seattle is continually working towards optimizing the existing freight network in the city, identifying ways

[217] "2017 Washington State," 89
[218] *Ibid.*
[219] "City of Seattle," 4
[220] "City of Seattle," 73

to manage travel demand. Each strategy, highlighted in Seattle's 2035 Comprehensive Plan's transportation element, is either an attempt to reduce car travel or incentivize transit through parking restrictions in new development and implementing more transit pass provision programs. This indicates the City of Seattle sees a solution to optimizing freight transit through the removal of cars from the roads. Eventually, removing a portion of I-5 through downtown Seattle and replacing it with an at-grade boulevard could facilitate that goal.

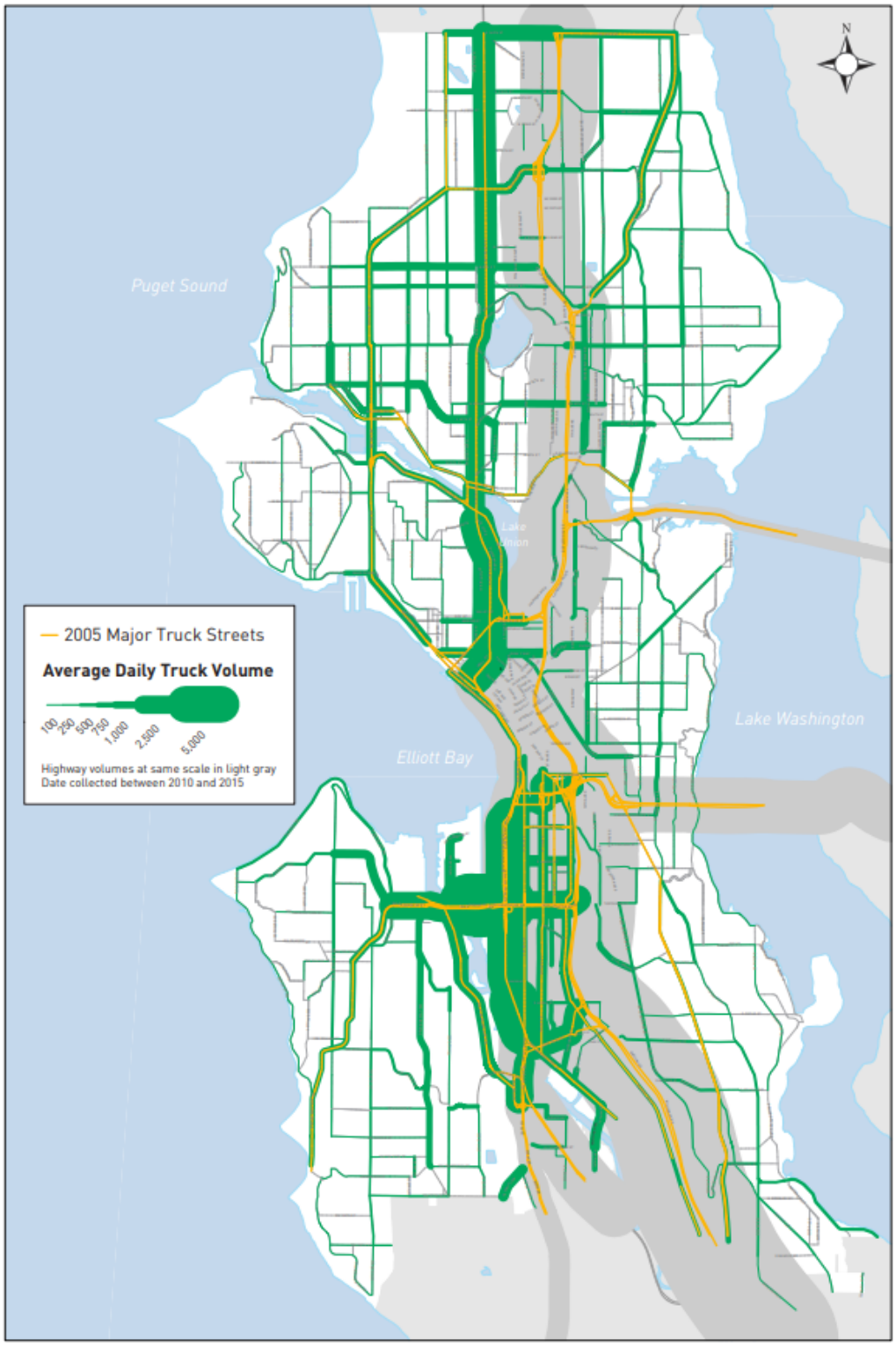

Figure 48 Average Daily Truck Volume on Seattle's Road Network

Source: Seattle Department of Transportation

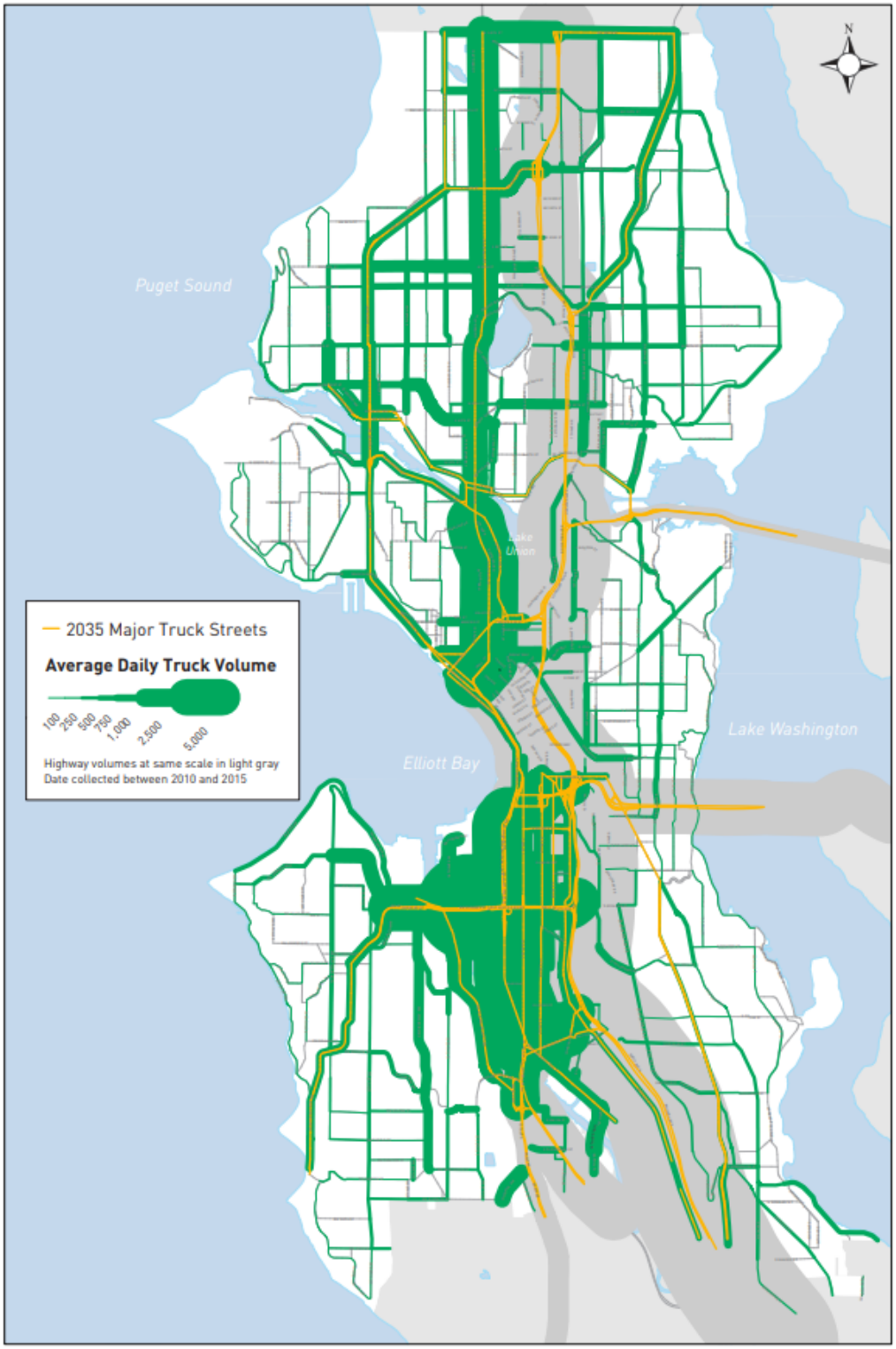

Figure 49 Average Daily Truck Volume on Seattle's Road Network in 2035

Source: Seattle Department of Transportation

Drawing from the Central Freeway example, grassroots advocates were forced to expand their aspirations and address important questions. What kind of neighborhood would emerge in the absence of the freeway? What aspects of the area should be reinforced if the street grid were knitted back together? Neighborhood meetings during San Francisco's public process allowed collective planning to take place.[221] Through this exercise the community was able to begin tackling issues like appropriate housing density, the impacts of parking, and the importance of a pedestrian and public realm in the neighborhood. Ideas of a better city emerged.[222] In Seattle, we have active and engaged media and citizen groups that should be a resource in consequential planning decisions such as the future of I-5. The Lid I-5 Campaign has been extremely involved with the community which has not only generated feedback and design suggestions, but it has also attracted attention allowing people to become more informed. However, with such an important topic such as the future of I-5, we should be exploring a removal and repurposing option, as well, because it stands to make for a better city in a more comprehensive way.

Chapter 5 CONCLUSIONS/RECOMMENDATIONS/FURTHER STUDY

5.1 Conclusions

The U.S. National Highway System is considered to be the largest civil engineering project in human history.[223] This massive project transformed the nation, accelerating suburbanization and leading to unprecedented levels of motorized mobility at a national scale. It brought about undeniable benefits, but it came with tremendous social, economic, environmental, and aesthetic

[221] Hastrup, "Battle for the Neighborhood"
[222] *Ibid.*
[223] Kraft-Klehm, "21 Century," 208

costs.[224] A legacy that cities all over the U.S. still struggle with today. Former Department of Transportation secretary Anthony Foxx, who served from 2009-2013, stated that "deeply embedded in our infrastructure are the values of past eras that accepted disconnections and that accepted a view of our country as folks who were in and folks who were out. I think we've got to have a different idea in the 21st century."

In the 1990s, Caspar Weinberger, the former state assemblyman for the neighborhood that fought the construction of the Embarcadero said their success in tearing down the elevated structure would not be an isolated incident. Now, freeway removal projects have taken place around the world, cementing Weinberger's theory that tearing down freeways and replacing them with multi-modal corridors could become a great public works project in the new century.[225] What is becoming clearer is that retrofitting, rebuilding, and continually maintaining highways is an extremely expensive endeavor, with cities and states struggling to keep up. Removing urban freeways and replacing them with roads such as at-grade boulevards that serve pedestrians, cyclists, cars, and transit are a lower-cost solution that meet transportation needs without crippling the budget.[226] By examining highways from a social standpoint, it's important to recognize how freeways built in vibrant cities like Seattle, were built on top of and through existing neighborhoods. Communities have continued to deal with their presence and the problems they generate, but removal creates an opportunity to reconnect communities and create more livable environments for all people. Advocates like Robert Cervero believe freeway removal in urban areas represents a reprioritization of urban policy that gives preference to planning for people and the neighborhoods they live in, not vehicular mobility. He believes that high-quality public transit

[224] Napolitan, et al., "Shifting Urban Priorities", 75
[225] Norquist "Wealth of Cities."
[226] Billings, "The Impacts"

options, bike and pedestrian-friendly corridors, and improved boulevard designs could diminish the necessity for high-capacity elevated freeway structures in urban areas all over the world.[227]

In examining and engaging theories such as "induced demand" and their associated case studies, it becomes clear that we will never be able to build our way out of traffic congestion. As Norquist points out, no road will never be big enough to accommodate the number of people who eventually want to use it.[228] With congestion levels rising in the Puget Sound region, it is time to reexamine infrastructure investments and give priority to those that move people and goods more efficiently. Removing a portion of I-5 is a sacrifice in mobility for some, but it has the potential to make transit more competitive, aiding the Puget Sound Regional Council's transportation demand management plan by incentivizing people to take public transit and directly pulling cars off the road. This could ultimately lead to a more efficient system overall which will help reduce emissions greatly, making downtown living an acceptable environment for human life. Comprehensive design, in the studies discussed in this thesis, have yielded net positive benefits without seriously sacrificing transportation performance, this is evidence that should not be ignored but instead, explored further.[229]

Policy shifts after the interstate era, have allowed for more flexible spending and allocated more federal dollars for mass transit. However, highways continue to receive the majority of funding because they are still the most prioritized form of transportation in the U.S. Additionally, many barriers exist to receiving special federal grants for innovative projects, like TIGER. Among the 40-60 projects that are submitted each year, only four grants in total have been awarded to freeway removal projects in New Orleans, Rochester, New York, and New Haven.[230] This is in

[227] Cervero, "Freeway Deconstruction."
[228] Norquist "Wealth of Cities."
[229] Cervero, "Freeway Deconstruction."
[230] Kraft-Klehm, "21 Century," 227

part because communities seeking the TIGER grant must demonstrate project readiness; providing concrete evidence of project milestones achieved and remaining, such as dedicating local funds to produce final design plans.[231] This puts a great deal of pressure on cities to use their own limited resources to develop a robust plan that may go unfunded and many cities are not prepared to take on the risk at this point in time.

While there are many freeway removal advocates who remain optimistic about the future of this growing trend, some remain cautious, due to the challenging barriers that exist within such complex projects. Robert Mohl acknowledges that the approach to freeway removal without freeway *replacement* has managed to capture the imagination of many, but at this point it has only been replicated in a few cities with special circumstances. For San Francisco, the Embarcadero and Central Freeway were unfinished pieces of a larger system never completed, so they did not play a crucial role regionally or even locally. Further, a major window of opportunity, the Loma Prieta earthquake, allowed the idea of freeway removal to become an option because the city had to function without the roads for a period of time and traffic eventually adjusted to their absence. Additionally, Napolitan and Zegras suggest that freeway removal will only move forward if other values exceed the perceived "value" of mobility.[232] In the case of San Francisco, a city with very active grassroots movements and political partnerships, other community objectives were valued more than mobility and those values were embedded in power. With Portland's Harbor Freeway Drive, the highway virtually became expendable with the construction of I-5 as an alternative route.[233] The honest reality is that most of the freeways removed in urban areas have been replaced with new and larger freeways in alternative corridors, or with a tunnel or a lidded trench. Freeway

[231] *Ibid.*
[232] Napolitan, et al., "Shifting Urban Priorities", 69
[233] Mohl, "The Expressway Teardown," 97

advocates have been mostly successful in recent local battles over freeways, as demonstrated in Seattle with the Alaskan Way Viaduct removal and replacement tunnel. Robert Mohl contends that "realistically no one expects that main-line highways that carry heavy auto and truck traffic through metropolitan areas will get torn down".[234]

For Seattle, the political barriers *appear* insurmountable for an I-5 removal project, especially in light of how Seattle policymakers and residents voted to spend billions of dollars on a tunneling project in order to keep a state route that carried 110,000 cars a day. Harnessing the necessary momentum to propose the removal of I-5 through downtown Seattle, a segment that carries 207,000 cars a day, and replace it will a boulevard feels like an impossibility in the current climate. While there have been major successes with urban freeway removal in some cities, demonstrating there does not necessarily need to be a tradeoff between place-making and economic productivity, these successes have mostly only been demonstrated by an increase in land value, not in regard to the regional economy. The freeways in the examined case studies did not play crucial roles in a U.S. regional economy the way I-5 does, making it difficult to definitively determine if the removal through downtown Seattle would result in net benefits for the city at this time. But while the examples examined in this thesis are not directly comparable to I-5 in Seattle, they helped to create a framework to begin examining what might be possible for Seattle and highlighted components that would need to be explored further in order to build a strong case for removal in the future.

5.2 Recommendations

The federal government has made steps to introduce design-focused programs that can help cities imagine new and creative ways of solving mobility issues created by past policy. The Every

[234] Mohl, "The Expressway Teardown," 97

Place Counts contest is a design challenge created by former DOT secretary, Anthony Foxx, to take steps to reexamine how neighborhoods once torn apart by highways can now have a different future. Backed by the Federal Highway Administration (FHWA) Every Day Counts program, the contest uses federal, state, and local resources for practices that enhance mobility and access while building opportunity and equity for local neighborhoods. In July of 2016, visioning workshops were hosted in four cities, Spokane, Nashville, Philadelphia, and Minneapolis-St. Paul, to engage directly with neighborhoods adjacent to planned or existing infrastructure projects.[235] They brought together federal advisors, state agencies, local officials, community organizations, and neighborhood residents to explore design and policy approaches to creating connected, economically prosperous, and healthy cities. The contest offers technical assistance to local governments to improve access to reliable, safe, and affordable transportation in areas where highways have formed barriers or isolated communities from easily accessing other parts town. The workshops are meant to inform, prepare, and enable recipients to better engage in federal transportation planning, programming and processes.[236]

One of the motivation of the "Every Place Counts" contest is to empower residents within communities to have a meaningful voice in transportation decisions that affect their everyday lives. Broad themes and common values emerged among leaders and residents: connectivity within and between neighborhoods; expanded green space and trails; improved safety for all road users including drivers, cyclists, and pedestrians; greater access for multi-modal transportation; increased prosperity without displacement, a higher quality of life, and preservation of community character and cohesion. They found that solutions to these issues and values, depending on present

[235] United States Department of Transportation. *Every Place Counts Design Challenge Summary Report. Washington, D.C.: United States Department of Transportation, 2016.*
https://cms.dot.gov/sites/dot.gov/files/docs/CNU.USDOT_Report_FINAL.pdf
[236] "Every Place Counts."

circumstances, could include lids, lowering elevated structures to ground level, or removing roads altogether. These broad values stand in sharp contrast to past federal transportation policy that focused squarely on the expansion of highways, creating hope of a new way forward for the many cities negatively affected by urban freeways. As a result, cities may feel more empowered to embark upon bold transportation projects in the interest of improving local quality of life. Through Every Place Counts, U.S. DOT is working to create infrastructure investment outcomes that reflect a more inclusive America, reconnect people to opportunity, and reinvigorate community engagement by empowering decision-makers to develop context-sensitive, stakeholder-drive solutions. However, at this point in time, there is no funding attached to the design challenge, the support is only through technical planning.[237]

Federal government challenges such as the "Every Place Counts Challenge" should no longer be contests or challenges to win, they should be best practices. The demonstrated and well-documented dichotomy between federal, state, and local priorities is a drain on financing because chosen projects may not always act in the best interest of localities and mistakes will eventually need to be corrected, adding more line items to state and local budgets where they could have been avoided. With the billions it would take to restore the interstate system, cities and states should be evaluating all options and aligning priorities before investing in infrastructure that is no longer meeting the local or regional needs, and ultimately may not play a necessary role in the near future.

One way of doing this would be to give urban freeway removal a solid foundation within national transportation policy. Closing this gap could help cities with local support for a removal project obtain equal footing and have greater access to programs and funding in order to conduct feasibility studies or more forward with implementation.[238] Kraft-Khelm calls for transportation

[237] Bigelow, "Future of Neighborhoods."
[238] Kraft-Klehm, "21 Century," 231

policy to be revised to grant decision-making authority to regional transportation authorities. She believes regional transportation authorities can be democratically elected legislatures, rather than boards consisting of state and agency appointed members. Kraft-Khelm sees this as a solution to the top-down decision-making approach currently in practice and ensure residents' views on highway removal are presented in local decision making.[239] Further, she believes MPOs should be required to examine the merits of repurposing segments of urban freeway identified as reaching the end of its design life or otherwise in need of significant commitment of federal aid funds for preservation.[240] This would greatly help cities who face major political hurdles, like Seattle, to begin conversations about their important but struggling highways and to help better determine the freeway's future role in an environment where transit is becoming more competitive and freight patterns are shifting due to changes in consumerism.

It is no surprise that mobility and livability are extremely intertwined, but with prioritization primarily given to the movement of automobiles in cities, they act in conflict with each other. However, through the review of case studies and literature the question arises: Need mobility and livability always be in conflict? As Robert Cervero points out, the presence of high-quality public transit as a legitimate mobility option seen in many cities all over the world demonstrates this conflict need not always occur.[241] In times of economic boom, public opinion polls repeatedly demonstrate traffic congestion is a factor in declining quality of urban life. Yet, in examining public policy it can be seen that the automobile is continually still favored, thus curbing automobile infrastructure has been part of the equation in finding a balance in many of the discussed cases. Additionally, while most states and local governments have faced significant

[239] Kraft-Klehm, "21 Century," 231
[240] *Ibid.*
[241] Cervero, "Transport Infrastructure," 223

funding cuts, none of them have significantly shifted their capital commitments to mass transit in order to confront the looming issue of how expensive maintaining highway infrastructure is.[242] States and cities will need to begin investing more heavily in mass transit in order to relieve, or at least maintain, congestion levels so as to not cripple mobility for all and sustain damage to their regional economies. This shift and incorporation of freeway removal as a solid policy program could help move cities away from automobile-centric infrastructure, ultimately leading to more efficient, robust and sustainable cities.

Altshuler and Luberoff favor a scenario within which there would be a flexibility in aid programs from both the federal and state governments in order to ensure each proposal can compete with others in local policy deliberations and requirements for substantial local contributions to confront local voters with the sharp reality of a project's benefits in order to determine if it is worth its costs.[243] They believe that even if there is little local funding involved in a project, major infrastructure projects have important land use, traffic, public safety, and other impacts within the environments in which they take place. If objections arise, there should be a democratic forum for which to express these views. While there may be appropriate times for state governments to override local objections for the sake of urgent regional needs, in general, overrides are very rarely justified.[244] Considering this in the context of Seattle, WSDOT may be unwilling to have a discussion about removing a portion of I-5 because, as a state department they will prioritize the importance of the corridor in the context of the entire state and its connections to other parts of the region. They may be unwilling to consider the localized set of needs and concerns within Seattle. While this could be framed as prioritizing the greater good of the region from

[242] Altshuler, et al., "Mega-projects."
[243] Altshuler, et al., "Mega-projects."
[244] *Ibid.*

WSDOT's standpoint, it will be important to consider the rising congestion levels and pollution to better understand how many people those issues effect directly. WSDOT should coordinate with regional transportation authorities and the city of Seattle in a more democratic process in order to determine if the regional needs supersede the local needs. If WSDOT remains unresponsive to the city of Seattle's objections or concerns with the retrofitting or rebuilding of I-5's downtown corridor and remained only concerned with their vested interests, a referendum could provide a mechanism for ordinary citizens to make themselves heard.

Formal traffic studies will prove crucial to giving freeway removal a better sense of legitimacy to an alternative that, on its face, appears radical.[245] Proposal evaluation should make sure to include an assessment of the negative impacts suffered by those whose travel conditions or opportunities are worsened (such as those who would be forced to change their preferred route, time, or mode) and the benefits enjoyed by those whose circumstances are improved (such as those better able to access bus services, safer and more accessible walking/cycling conditions, and better air quality).[246] But the traffic studies within proposals will need to be robust and be careful not to make assumptions past traffic studies have made. Evaluating the existing street network to determine if excess capacity exists and can support demand will also be crucial. The studies should also be careful not to assume that all traffic from the freeway will require accommodation. Additionally, Napolitan and Zegras assert that removal projects need to have pre and post project evaluations, which so far, is not common practice. A post project evaluation would provide insight into where traffic went and what, if any, congestion was generated.[247] This would demonstrate the real role of the infrastructure from an accessibility standpoint.

[245] Napolitan, et al., "Shifting Urban Priorities", 74
[246] Cairns et al, "Traffic Impact"
[247] Napolitan, et al., "Shifting Urban Priorities", 74

It will be important for cities to address the assumptions that arise in freeway removal projects. One way to do this is through a robust Transportation Demand Management (TDM) plan to help manage capacity, and to provide reassurance to those concerned about congestion chaos, as TDM has proven its ability to manage travel demand.[248] Successful TDM policy invests in reliable and frequent transit service, and uses strategies like the management of parking and its pricing. Investing in mass transit with funds saved through the deconstruction of urban freeways and reducing the subsidies for parking will help shift drivers to transit and reduce pressure on the existing road network. Seoul's removal of the Cheonggyecheon Highway is a great example. Once the freeway was removed, traffic in the area dropped by 9 percent and transportation demand was managed through the completion of a bus rapid transit line and an increase of parking fees city-wide. The city effectively dealt with mobility needs of the area. This project is now an example of best practice internationally.[249]

5.3 Further Study

Many of the case studies have limited results but remain helpful in creating a framework to at least examine opportunities and build a case for future analysis. In order to better determine the possibility of freeway removal for cities who may become interested, it will be important for new projects to conduct pre and post removal evaluations, evaluations that examine wider possible effects than just the traffic impacts; including safety, accessibility, environmental impact and the social economic consequences.[250] For Seattle's I-5 corridor, it has been challenging to build a case for removal based on available literature and studies, as no examples exist at the moment that act

[248] Ebeling, Mary. "Rethinking the Urban Freeway". Mayors Innovation Project, 2013, https://www.mayorsinnovation.org/images/uploads/pdf/SURDNA_freeway_brief.pdf
[249] Ebeling, "Rethinking the Urban."
[250] Cairns et al, "Traffic Impact"

as a major north-south regional corridor and carry the amount of traffic I-5 does. However, with advocates like Congress for New Urbanism highlighting *Freeways without Futures*, there is a chance for bolder targets in the future. For example, Denver's I-70 corridor, listed in 2017, carries nearly 200,000 cars a day at its peak and is a major east-west regional corridor, acting as one of the only connections between the front range and mountains to the west.[251] However, the viaduct destroyed several low-income neighborhoods when it was constructed and has since become heavily congested. With the Colorado Department of Transportation planning an expansion and more resident displacement, the project has attracted outrage from environmental groups and locals who would rather see a multi-modal boulevard implemented instead.[252] This example could become an important case study in the future once a solution is determined and implemented.

5.3.1 Wasatch Front Central Corridor Study, Utah

From southern Davis County to northern Utah County, the state of Utah is facing a similar problem to the Puget Sound region in Washington. A substantial amount of growth is expected in the next 30 years that will quickly begin to strain their already stressed infrastructure along the I-15 corridor.[253] This region in Utah is also geographically constrained by two mountain ranges and the Great Salt Lake, so increasing road capacity is infeasible. With the corridor acting as a crucial part of the economy, officials understood that a comprehensive transportation plan would be essential to managing the expected growth successfully. Utah's four largest transportation agencies

[251] Colorado Department of Transportation. *Traffic Data Explorer*, 2016, accessed May 3, 2018, http://dtdapps.coloradodot.info/otis/TrafficData#ui/1/1/0/criteria/070A/0/449.589/true/true/.
[252] "Freeways without Futures," Congress for New Urbanism, accessed May 3, 2018. https://www.cnu.org/highways-boulevards/freeways-without-futures/2017#70.
[253] Utah Department of Transportation. *Wasatch Front Central Corridor Study*. Utah Department of Transportation, Utah Transit Authority, Mountainland Association of Governments, Wasatch Front Regional Council, 2017, accessed on April 26. 2018, http://wfccstudy.org//wp-content/uploads/2017/09/WFCCS_Final_Report_Summary_8_5x11_8_11_17-2.pdf

came together to conduct the Wasatch Front Central Corridor Study, receiving a TIGER grant.[254] During a presentation at the National American Planning Association Conference in New Orleans this past April, representatives from the project discussed two key messages from the project. The first was a required collaboration across agencies to solve the identified problems. They first began by asking themselves "How do we make life better?", and from there sought to establish their shared goals across agencies. These shared goals were agreed upon with the assumption that areas along the corridor might have its own set of customized goals, but that it was important to establish the shared ones for a more comprehensive output.[255] The presenters at the conference spoke to how Utah's unique collaboration made the study possible, highlighting how the public and legislatures operate under an expectation that departments heavily coordinate their projects, ultimately making it easier for the public to understand one unified plan rather than an array of disjointed documents. The second

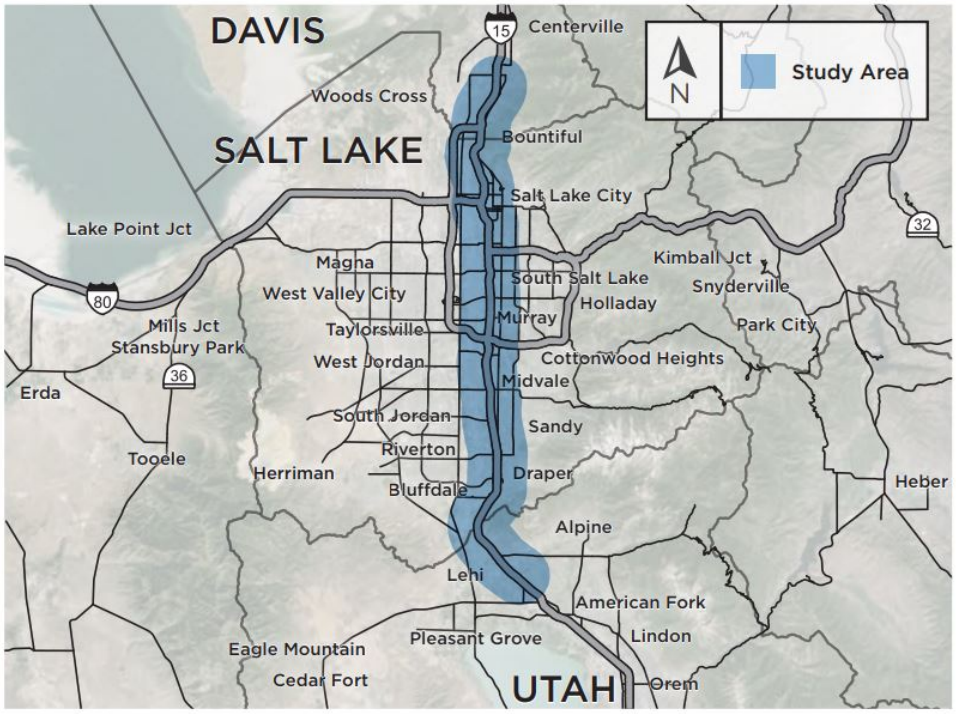

Figure 50 Wasatch Front Corridor Study Area

Source: http://wfccstudy.org//wp-content/uploads/2017/09/WFCCS_Final_Report_Summary_8_5x11_8_11_17-2.pdf

[254] *Ibid.*

[255] Knowlton, Ted, Shawn Seager and Nandini Vyas. "Mega-Corridor Planning for an Uncertain Future." Presentation, National American Planning Association Conference, New Orleans, LA, April 21, 2018.

key message that emerged from the study was an understanding that the way of the past is not the way forward. They began the study by establishing the premise that nothing was *on* the table and nothing was *off* the table, asking themselves questions such as, "how do we move people more efficiently on surface streets?", "how to do we get transit ridership up?", "how do we get people walking and biking more?". They also closely examined the opportunity costs in each scenario explored, asking the question "if you choose not to do something, what will it cost in opportunity?"[256]

Overall, the three scenarios explored held commonalities in the way they integrated I-15, surface streets, transit, and active transportation, but they differed in their placement along a spectrum that ranged from building more infrastructure to managing with existing conditions.[257] While it remains to be seen how this important corridor in Utah will be transformed and how successful the chosen scenario will be, and while freeway removal was not considered in any of the scenarios explored, the collaborative process the agencies engaged in to investigate such a complex and important problem is a practice many other states and cities should adopt in order to better invest their transportation dollars in the most effective way in times of growth and under geographic constraints. For Utah, they approached their constraints as opportunities, understanding how they necessitated the need to explore more options and experiment with bold initiatives like free transit days that help get people out of their personal cars and off the roads.

In the Puget Sound region, it will not be effective to expand highways and invest in light rail equally on the same corridor, because people will always choose what is most convenient for themselves, meaning they will almost always choose to drive their own car if faced with both

[256] Knowlton et al., "Mega-Corridor Planning."
[257] "Wasatch Front Central."

choices. It will be essential for Seattle not to choose competing investments. A way to avoid this costly mistake is by viewing a robust spectrum of options and implementation over time as driving, consumer, and freight patterns shift.

Since right now removing a portion of I-5 does not appear to be feasible without more study, but maintaining the status quo could have significant consequences, we could begin exploring options that could immediately reduce traffic congestion which would help alleviate several of the issues I-5 creates, such as pollution and freight delay. This could begin with tolling more localized trips on the freeway in an attempt to reduce the discretionary trips that often clog the downtown corridor. Eventually as people adjust to new circumstances, increasing limitations by only allowing mass transit during peak hours or dedicating certain lanes for freight movement could also help reduce demand and congestion on the corridor. Overtime, as local and regional transit expands, drivers become less dependent on the roadway, and freight patterns shift the highway corridor through downtown Seattle could be phased out.

5.3.2 Period of Maximum Constraint

An important opportunity for Seattle to begin testing these ideas has already arrived. Mobility in Seattle, especially downtown, is facing what is being referred to as the "period of maximum constraint". During this time period, likely to range from early 2018 to 2021 many construction and transportation projects will get underway, causing a strain on mobility. During this time period, experts are expecting congestion to worsen. Buses will be removed from the downtown tunnel and put onto cities streets, with some detoured to slower routes. Simultaneously, road capacity will be reduced in a few areas. Meanwhile the light rail fleet, which is intended to absorb much of the population growth expected, is not going to increase enough to fit the growth

comfortably until 2021.[258] This period is marked by several major projects; the 1st Avenue Streetcar (formally known as the Center City Connector), the SR-99 tunnel and the Alaskan Way viaduct demolition, building projects downtown, and light rail expansion. In light of the many variables involved in each of these projects, experts have been unable to provide much information on expected delay times.[259] In January of 2018, crews began construction on the streets of 1st Avenue in order to install the necessary utilities for the Center City Connector. Construction is projected to be complete before the SR-99 Tunnel opens and the Alaskan Way Viaduct is demolished so that traffic displaced from the Alaskan Way surface street can be rerouted to 1st Avenue. The tunnel is expected to open in late 2018, though this has shifted frequently.[260] However, one component that makes this period daunting is the closure of the viaduct in November of 2018 while ramps between the surface and the tunnel are attached in South Lake Union and South Downtown, meaning there will be a period of time where there is no viaduct and no tunnel.[261] All of this is actively evolving, so no one is certain how the period of maximum constraint will play out, but it serves as a unique opportunity to incentivize mass transit and examine how traffic adjusts to these new circumstances.

[258] Brenner, Jim and Daniel Beekman. "Transportation Reporter Mike Lindbloom on Seattle's 'Period of Maximum Constraint'". *The Overcast: Seattle Times politics and more.* Podcast audio, February 12, 2018. https://www.seattletimes.com/seattle-news/politics/podcast-whats-behind-the-period-of-maximum-constraint-for-seattle-traffic/

[259] Brenner et al., "Transportation Reporter."

[260] Seattle Department of Transportation. *One Center City Seattle's Near-term Action Plan Executive Summary*. Sound Transit, King County Metro, Seattle Office of Planning and Community Development, Downtown Seattle Association, 2018, accessed on April 30, 2018, https://onecentercity.blob.core.windows.net/media/Default/ResourceLibrary/OCC_NearTermActionPlan_SUMMARY.pdf

[261] Brenner et al., "Transportation Reporter."

Figure 52 One Center City Transit Improvements

Source: Seattle Department of Transportation

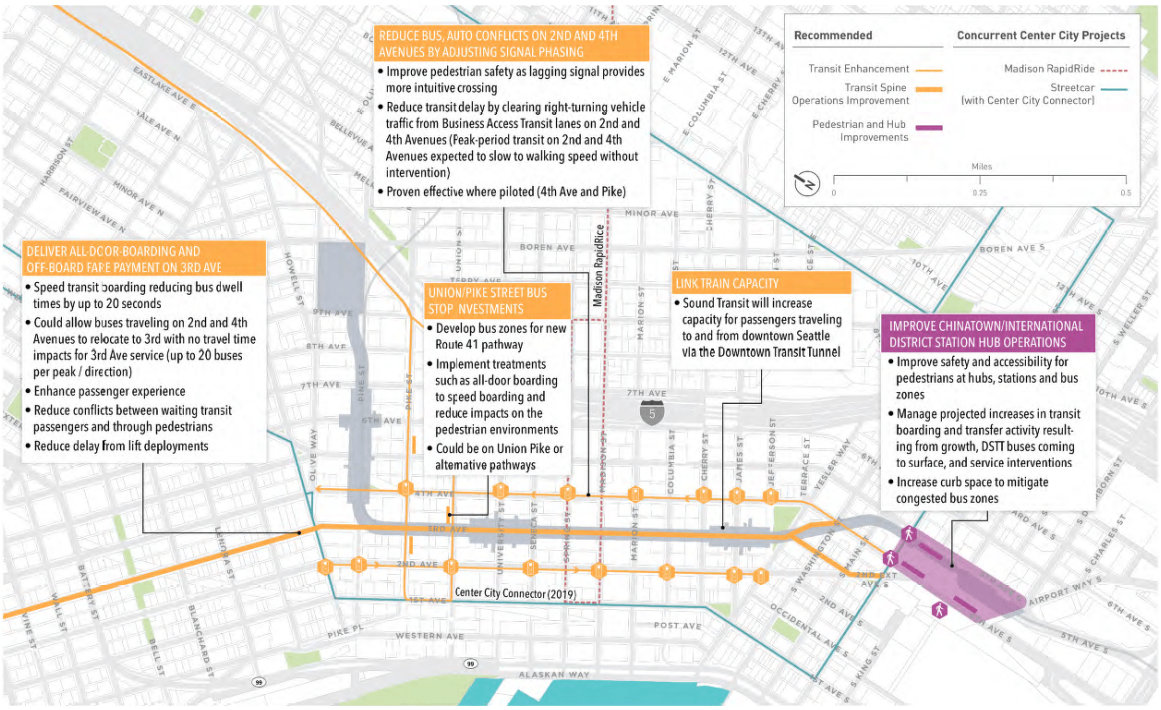

Figure 51 One Center City Near-term projects

Source: Seattle Department of Transportation

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